

United States
Department of
Agriculture

Forest
Service

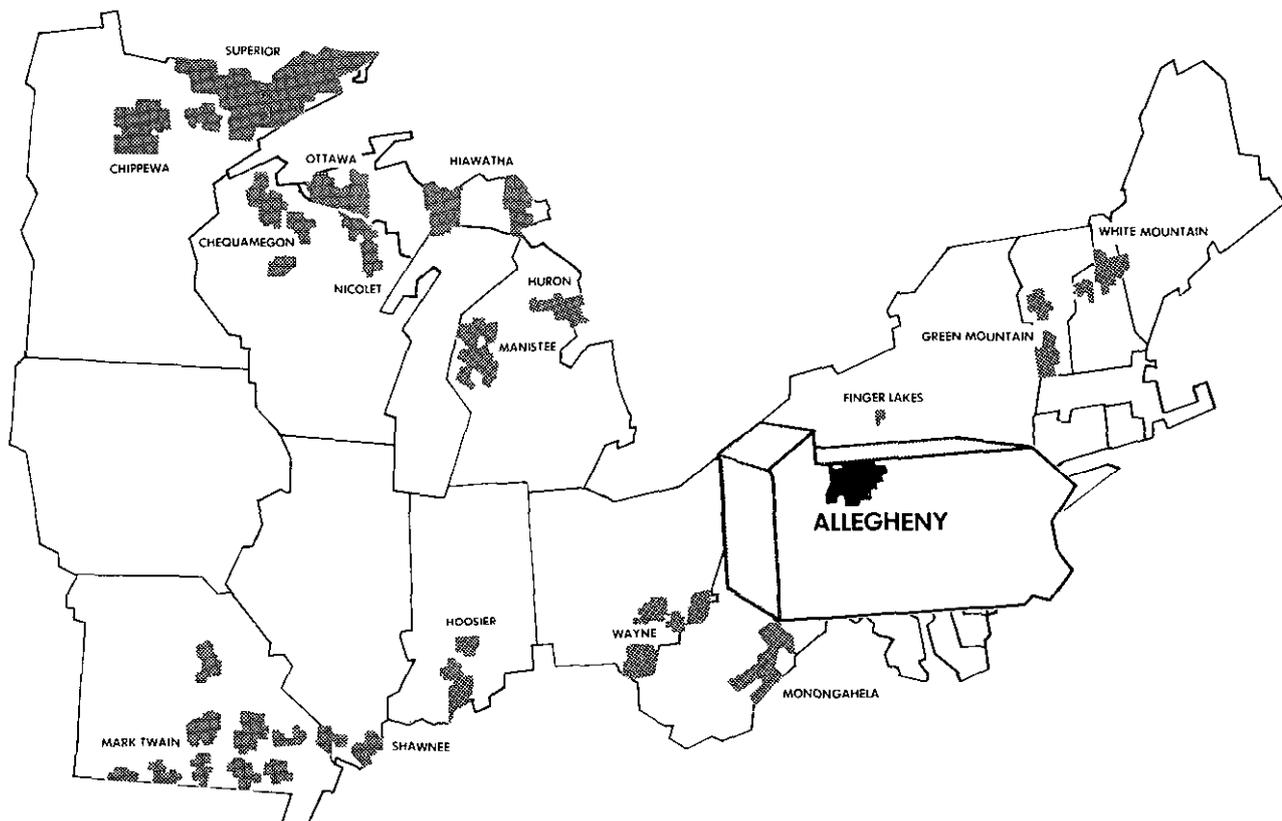
Eastern
Region



Appendix B Final Environmental Impact Statement

Land and Resource Management Plan

ALLEGHENY NATIONAL FOREST



The Allegheny National Forest

APPENDIX B
(Analysis Appendix)

of the
Final Environmental Impact Statement
for the
Land and Resource
Management Plan

Eastern Region
USDA - Forest Service

March 1986

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APPENDIX B

I. INTRODUCTION

A. The General Planning Process

Although the Forest Service had managed the National Forests under a multiple-use concept for many years, no specific direction to do so existed until the passage of the Multiple-Use Sustained Yield Act of 1960. From this point, several additional pieces of legislation were passed to ensure multiple-use management of the National Forests - the National Environmental Policy Act of 1969 (NEPA) and the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA). The culmination of Congressional efforts to settle the controversies arising over the direction of management of the National Forests was the passage of the National Forest Management Act of 1976 (NFMA).

The planning process as described in NEPA was conceived within the framework of system analysis. That is, the planning process was seen as a rational analytical means of solving the complex problems associated with a multiple-use form of forest management.

The NEPA process as set forth in FSM 1950 describes an eight step environmental analysis process, followed by documentation of the analysis, a decision of the adopted alternative, and implementation and monitoring of the accepted alternative.

The 1979 version of the regulations (36 CFR 219.5) outlines a ten step process which closely follows the steps outlined in the NEPA process:

Step 1: Identification of issues, concerns, and opportunities - In any systematic approach to problem solving, the first step is to identify the problem. In this step, the interdisciplinary team (ID Team) identifies and evaluates public issues, management concerns, and resource use and development opportunities. What does the public want? What does the Forest Service want? What needs to be done?

Planning Process

Step 2: Planning criteria - The issues, concerns, and opportunities (ICO's) collected and evaluated in step 1 will be used to develop decision criteria for evaluating alternatives. Decision criteria are also used to guide the collection and use of inventory data, analysis of the management situation, and the design and formulation of alternatives. What tests, rules, and guidelines are needed to complete the plan and select the best solution?

Step 3: Inventory data collection - Based on the ICO's, data will be collected which will allow analysis of the problems identified. What are the resources available? In what amounts?

Step 4: Analysis of the management situation - In this stage, the Forest will estimate the range of various goods and services it can produce, projections of demand, potential to resolve public issues, and the technical and economic feasibility of providing various levels of goods and services. The purpose of this section is to allow the Forest to establish or change management direction to better resolve the ICO's.

Step 5: Formulation of alternatives - A reasonable range of Forest plan alternatives will be formulated to provide a variety of ways of responding to the ICO's. Each major problem must be addressed in at least one alternative.

Step 6: Estimated effects of alternatives - What will happen if a certain set of management prescriptions is chosen? This stage estimates and displays the physical, biological, economic, and social effects of implementing each alternative.

Step 7: Evaluation of alternatives - The significant physical, biological, economic, and social effects of each management alternative are evaluated. Alternatives are evaluated with respect to the planning criteria.

Step 8: Selection of alternative - Using the decision criteria, a preferred alternative will be selected.

Step 9: Plan implementation - The preferred alternative will be used to develop multi-year program proposals. These proposals will be consistent with the standards and guidelines set forth in the plan.

Step 10: Monitoring and evaluation - A monitoring plan will be established to evaluate how well objectives have been met and how closely standards and guidelines have been applied. Evaluation reports will be required. Based on these reports, the plan will be revised or amended as necessary.

1. Complexity and magnitude of the problems.

There are so many connections among the ten planning steps, just presenting the steps may not provide a clear picture of the analytical structure or decision-making process. Another way to convey an understanding of the process is to identify the three phases which occur during the process: (1) judgemental or selection phase, (2) analytical phase, and (3) execution phase.

Planning steps 1, 2, 7, and 8 make up the judgemental or selection phase of the process. In this phase, ICO's are identified, and decision criteria are established. Then based on the analytical phase, a preferred alternative is chosen. No one alternative will satisfy all goals and objectives better than the others. The decision maker will need to compare the trade-offs between alternatives and make a judgment about which ICO's and objectives are most important and then select the appropriate alternative to maximize net public benefit.

Planning steps 3, 4, 5, and 6 represent the analytical phase of the process. Appendix B is primarily concerned with this portion of the process. In this phase, data is collected which addresses the ICO's and objectives of the Forest. Estimates of the Forest's potential to address the ICO's are developed. Alternatives which focus on producing various combinations of goods and services are developed and the effects estimated. This information is then provided to the decision maker to use in choosing a preferred alternative.

The final phase is implementation and monitoring (planning steps 9 and 10). Planned actions will not always produce the desired results. Through monitoring and evaluation, inconsistencies between desired conditions and actual results can be identified and corrected.

2. Opportunity for the use of analytical techniques in analytical phase.

Development of a Forest Plan through the planning process outlined presents an extremely complex analytical process. The regulations require that each plan alternative must be the most cost efficient schedule of management practices, subject to the constraints applied to the alternative. Based on the complexity of the Forest planning process, the Forest Service decided that a linear programming approach to the problem was necessary to assure compliance with the cost efficiency requirements in the regulations. A linear programming/goal programming model known as FORPLAN is being used by all National Forests in this Land Management Planning process.

3. Revision of Problem Statements

Based on public, region, and forest review of the Allegheny National Forest's analysis appendix, the problem statements have been revised. Both the original and revised problem statements are listed below:

Original Problem Statements

- Problem 1: Mix of Recreation Opportunity
- Problem 2: Quantities of Timber
- Problem 3: Integration of Outstanding Mineral Development
- Problem 4: Wilderness

Revised Problem Statements

- Problem 1: Providing Developed Recreation Opportunities
- Problem 2: Providing Dispersed Recreation Opportunities
- Problem 3: Timber Management
- Problem 4: Wildlife Habitat
- Problem 5: Private Oil and Gas Development
- Problem 6: Wilderness

Revised problem statements 1 and 2 are a further refinement of the original problem statement 1. Revised problem statement 3 was derived from part of original problem statement 2. Revised problem statement 4 is a combination of various parts of original problem statements 1, 2, and 3. Revised problem statements 5 and 6 are rewrites of original problem statements 3 and 4, respectively.

The reasons for these revisions are to clarify and better emphasize areas of the problems. Revising the problem statements is a dynamic process and will continue throughout the planning process in an effort to better define and display the problems. Unless the revisions cause a change in constraints or objectives of an alternative, there is no reason to change the analysis. The changes to date have not affected the alternatives and, therefore, Appendix B, and any discussion of the problem statements in the appendix, is based on the original problem statements.

4. Pennsylvania Wilderness Act of 1984

As a result of the passage of the Pennsylvania Wilderness Act of 1984 on October 30, 1984, the Hickory Creek Wilderness, Allegheny Islands Wilderness, and the Allegheny National Recreation Area were established. The Act releases all remaining RARE II areas from further analysis for wilderness designation until the next planning cycle.

II. INVENTORY DATA FOR INFORMATION COLLECTION

A. Information Organization

Organizing information into an acceptable format for analysis required us to refer to many individual data sources existing on the Forest. Some data sources provided more detail than we could use at this level of planning, while others contained notable gaps in the resource information relating to analysis problems. Section II.B displays a brief list and explanation of the more important data sources used. This section briefly describes the more important information sources used in constructing our final data base. Section III describes how we used this information in the analytical process, specifically the FORPLAN model.

1. Ecological Areas

The 1973 General Soil Inventory of the Allegheny National Forest provided broad soils information and identified broad land type groups for the Forest. A 1981 study, Ecological Land Typing and Field Measurement Analysis, sought to further refine these into Ecological Land Types (ELT) based on soil associations, vegetative indicator species, and climax community types. Since the results of this study were inconclusive, land type groups based solely on physiography or general landform became the basic ecological areas. They differentiate the general land units which have relatively uniform suitability for, or responses to management. Future analysis, perhaps using additional landform categories or the recently completed soil conservation service soil series maps, will establish the specific ecological classification system for the Forest.

2. Analysis Areas

The Forest used the following criteria when initially selecting the resource layers:

- Is it relevant to the planning problems,
- Is data currently in the Forest files,
- Favor layers which provide information useful to more than one resource area,

- Layers should separate land units having significant cost and yield differences for a given management practice.
- The number of analysis areas should be as small as possible, with a maximum of 300.

Using these criteria, we developed the following initial list of resource layers which we felt would allow us to analyze the resource problems using available information:

- Areas with significant public interest and concern,
- Areas with significant differences in road building needs and Recreation Opportunity Spectrum (ROS) potential,
- Areas with significant differences in the potential for oil and gas development,
- Basic resource capability unit,
- Timber Types,
- Stocking level or site index (depending on the timber type),
- Existing age.

Section III.C. contains a detailed discussion of the final analysis area delineators we included in the FORPLAN model.

3. Production Coefficients

a. Timber

Production coefficients or yields are an integral part of the analysis. A wide variety of timber data sources and yield estimation techniques played an important role in the development of the final version of the timber yield tables. Some production coefficients come from published yield tables developed for a broad geographic area, which we tempered using our professional judgement and experience to reflect local timber production capability. Other coefficients resulted from taking local timber inventory data for specific stands and using a local timber growth simulator called SIMAH (Simulation Model for Allegheny Hardwoods) to generate the timber yield coefficients used in FORPLAN. The Timber Management Information System (TMIS) provided

most of the timber inventory data. Finally, for timber types which comprise a small portion of the forest, we examined several other Forests' yield tables (produced generally using the STEMS timber growth simulator), picked the one which most closely resembled our stands, and then tempered it using our professional judgment and local experience.

In summary, the effort we expended to develop a given yield table was directly proportional to the significance of the timber type, relationship to planning problems, or the applicability of the overall management prescription to the Forest. Section III.E.1. provides additional detail by timber type concerning yield table development. Section II.B. provides specific source information.

Timber yields from published yield tables or produced by growth simulators using inventory data require adjustment for small inclusions of land which will produce lower or no timber yields and which are not accounted for in the inventory data. Consequently, we have applied a timber volume adjustment factor to the yield tables in the FORPLAN model. This factor accounts for the following kinds of timber yield reductions:

- Visual Quality standards and guidelines,
- Steep Land, Rocky Land, Riparian Area standards and guidelines,
- Wildlife opening inclusions,
- Land cleared by intensive oil and gas development,
- Existing roads and rights-of-way.

Section III.E.1.h. provides additional information on these adjustments.

b. Wildlife

The TMIS data base provides information on existing wildlife habitat. The Pennsylvania Game Commission's historical data on hunter use coupled with professional judgment established the basis for the big-game hunter-use production coefficients. We estimated small-game and non-game use outside of the FORPLAN model once we completed modeling each alternative. The Recreation Information Management system (RIM) provided comparison

information on hunting use as well as estimates for non-game visitor use. See additional detail in Section III.E.3.

c. Recreation

We estimated recreation yields for each prescription using the following process:

- examine sample land areas on the ANF for each ROS class,
- use them as the base line to calculate potential RVD yields for each ROS class, and
- modify these yields to fit the theme of each prescription and estimate actual yields for each management intensity.

The RIM system was useful in summarizing developed and dispersed recreation facilities and historical recreation use for the Forest. Mapped visual quality objectives displayed the specific locations of the various visual resource sensitivity levels. See additional detail in Section III.E.2.

4. Suitability for Management Practices

Two levels of analysis during the planning process aided in determining the management practices which are tentatively suitable for specific analysis areas. First, we examined specific analysis areas and groups of analysis areas, and specified which management prescriptions or general management strategies were practical to apply to each area. Some management prescriptions are not suitable on certain areas; for example, a wilderness prescription is impractical on an area with intensive road development or on an area showing significant evidence of intensive timber management. For a summary of this prescription suitability on analysis areas, see Table B-4 in Section III.D.3.a.

The second level of suitability concerns the suitability of "FORPLAN prescriptions" to analysis areas. These prescriptions are more site specific. They relate to vegetation characteristics, land type groups, regeneration characteristics, stocking/site index, and

the value of the specific timber species. Each "FORPLAN prescription" reflects all of the significant management activities required to produce the specified yields and land condition called for in that prescription. The same end result on another analysis area may require a different set of activities. For example, regenerating an oak analysis area calls for different practices than regenerating an Allegheny Hardwood analysis area. Table B-5 in Section III.D.3.b., displays a brief summary of this type of suitability determination.

5. Develop Allocation and Scheduling Alternatives

The analysis areas are the smallest land units defined in the FORPLAN data base. Management prescriptions define the major management strategies available on the analysis areas. The FORPLAN prescriptions, then, define specific sets of practices (or alternative sets of practices) required for each analysis area to achieve the major management emphasis. FORPLAN prescriptions contain the costs for the specific practices as well as the outputs (production coefficients) defined in Section II.A.3 above. The suitability analysis defined in Section II.A.4. above identified suitable prescription choices for each analysis area.

With these basic building blocks, we can develop benchmarks and Forest Plan alternatives. Each benchmark or Forest Plan alternative contains a set of objectives which translates into specific FORPLAN constraints. FORPLAN then determines the mix of prescriptions (for each analysis area) required to meet the objectives specified for each alternative or benchmark and to maximize present net value (PNV). Each prescription mix calls for a specific set or schedule of associated practices having specific associated inputs (costs) and outputs (benefits). Sections VI and VII describe the details regarding development of alternatives and benchmarks.

6. Monitor Implementation

The Forest Plan contains monitoring and evaluation requirements that will provide a basis for periodic evaluation of the effects of management practices. It

establishes intervals for evaluating how well the management of and outputs from Management Areas are meeting the objectives established in the Forest Plan. Evaluation will also determine how closely management practices within the Management Areas have followed the standards and guidelines specified in the Forest Plan. Monitoring will verify the validity of the data used to develop the Plan. If we discover significant errors in cost or yield estimates, we can revise our data collection so future analysis will utilize sound information. Monitoring and evaluation will help the Forest determine whether the prescriptions and the allocations have succeeded in satisfactorily resolving the issues included in the problem statements identified during this cycle of planning. Finally, the evaluation process will no doubt identify some new significant issues or resource demands, which we will address during future Forest Plan revisions.

7. Develop Subsequent Programs for Plan Implementation

Much of the data used to develop alternatives will be used to prepare programs and projects for implementing the Plan. The final mix of prescriptions which forms the solution for the alternative (see Section II.A.5. above) specifies activities needed, the amount of each activity, the timing of the activity, and the resulting outputs. Aggregating these activities, their amounts, and their timing by decision variable defines specific resource programs for implementing the alternative. The Forest Plan displays these for the preferred alternative.

8. Definitions for Management Information

The Management Information Handbook (MIH 1309.11a) provides the definitions for outputs, activities, effects, and other information produced through the planning process. This provides the link between the Forest Service Management Model, existing analytical tools, and the Forest Plan.

B. Primary Data Sources

The Allegheny National Forest staff used or considered the following data sources during the information gathering stage of the planning process.

1. General Soil Inventory of the Allegheny National Forest

Wayne E. Humbert, Soil Scientist, 1973.

This Allegheny National Forest publication presents broad soil information, identifies physiographic land types, and gives soil interpretations based on probable hazards or suitability for management.

2. Soils Report: Soils of the Allegheny National Forest

Wayne E. Humbert, Soil Scientist, 1970.

3. Ecological Land Typing and Field Measurement Analysis

Rev. Austin J. O'Toole, Ph.D.; Northwest Institute of Research; July 31, 1981; Contract Number 53-56A1-9-00241;

A study conducted under contract on the Allegheny National Forest which sought to verify Ecological Land Types through vegetation analysis.

4. Interim Soil Survey Report ss for Elk, Forest, McKean, and Warren Counties

Soil Conservation Service, 1983.

Soil series maps for the Allegheny National Forest.

5. SIMAH - Version 1

Northeast Forest Experiment Station, Warren, Pennsylvania.

This preliminary Simulation Model for Allegheny Hardwoods (SIMAH) is a stand table projection model which is distance independent and contains growth coefficients based on individual tree measurements.

6. Timber Management Information System (TMIS)

A nation-wide Forest Service data management system, TMIS, is designed for storing and retrieving timber related information by all levels of forest managers. Information in TMIS comes from forest inventories, silvicultural examination, accomplished projects, and timber management plans.

7. Recreation Information Management System (RIM)

This locally collected data base provides recreation facility and site inventory data as well as recreation activity use statistics. It also contains field estimates of hunting, fishing, and non-game wildlife use.

8. Stand and Tree Evaluation and Modeling Systems (STEMS)

Timber growth and yield simulation model containing coefficients developed from growth plots in the Lake States. A number of Forests in Region 9 used STEMS to develop their yield tables. We did not make any STEMS runs when preparing our yield tables. However, when we prepared yield tables for some of the timber types which are a minor component of the Allegheny National Forest, we used some of the STEMS yield tables developed for other Forests.

9. Pennsylvania Game Commission historical data on hunter use

We referred to this when developing our hunting use estimates for the various Forest Plan alternatives.

10. Allegheny National Forest resource maps

Existing forest maps developed to serve the needs of specific resource areas (timber stand maps, Visual Quality Objective maps, OGM ownership maps, maps of known oil and gas fields, road system maps, etc.) provided important information used to develop analysis areas.

11. Spruce Yield Table

The Chippewa National Forest provided us with a copy of the spruce yield table they developed for their FORPLAN model using STEMS.

Primary Data Sources

12. Spruce Yield Table

The White Mountain National Forest provided us with a copy of the spruce yield table they developed through consultation with the Forest Experiment Station at Durham, New Hampshire.

13. Red Pine Yield Table

USDA-Forest Service Technical Bulletin #1272; Growth and Yield of Red Pine in Minnesota; 1962.

14. White Pine Yield Table

Growth and Development of Older Plantations in Northwestern Pennsylvania; NE-104; Northeastern Forest Experiment Station, Warren, Pennsylvania; Ted Grisez, 1968.

This local work provided comparative data used when constructing the red pine yield table for the FORPLAN model.

15. Aspen Yield Table

The Chippewa National Forest provided us with a copy of the Aspen yield table they developed for the FORPLAN model using STEMS.

16. Aspen Yield Table

Quaking Aspen: Silvics and Management in the Lake States

USDA-Forest Service, December 1975, Agricultural Handbook #486.

Published aspen yield tables for the Lakes States.

17. Oak Yield Tables

Growth and Yield Predictions for Upland Oak Stands

Martin Dale, 1972, Northeast Forest Experiment Station Research Paper NE-241.

These published yield tables provided the basis for the oak yield tables included in our FORPLAN model.

18. Conifer Yield Tables

Biologic and Economic Feasibility of Coniferous Timber Production Systems for the Allegheny National Forest

Dr. Charles H. Strauss, Consultant Resource Economist, and Dr. Todd W. Bowersox, Consultant Silviculturist; October 1, 1982.

This publication is a study conducted under contract for the Allegheny National Forest to determine the potential for softwood production here.

19. Conifer Yield Tables

Hockinson, Joel; 22 Feb. 1983; "Softwoods - Non-FORPLAN Report on Status"

An Allegheny National Forest report prepared to supplement Strauss & Bowersox report. This analysis included softwood price trends from RPA and local historical price trends for hardwoods.

20. Prescription 6.5

Shands, William E. and Healy, Robert G.; 1977; The Lands Nobody Wanted

Discusses management policies for Eastern National Forests, including the Allegheny National Forest.

21. USDA-Forest Service; 198 ; ROS User's Guide

A guide for recreation resource input into Land Management Planning.

22. Costs

The Forest ADVENT Data Base provided the basic information we used to develop costs for the Forest Plan. ADVENT is the annual program budgeting data base which includes projects, the individual activities which comprise them, and the cost for each activity.

Primary Data Sources

23. Wildlife Indicator Species

Anderson, S.H.; C.S. Robbins; J.R. Partelow; and J.S. Weske; 1981. Synthesis and evaluation of avian population and habitat data for Pennsylvania. Non-game Section, Migratory Bird and Habitat Research Laboratory, U.S.F.W.S. 407 pp.

DeGraaf, R.M.; G.M. Witman; J.W. Lanier; B.J. Hill; and J.M. Keniston; 1981. Forest habitat for birds of the northeast. Northeast Forest Experiment Station and Eastern Region, U.S.D.A.-Forest Service. 598 pp.

Degraaf, R.M.; G.M. Witman; and D.D. Rudis; 1981. Forest habitat for mammals of the northeast. Northeast Forest Experiment Station and Eastern Region, U.S.D.A.-Forest Service. 182 pp.

Degraaf, R.M. and D.D. Rudis; 1981. Forest habitat for reptiles and amphibians of the northeast. Northeast Forest Experiment Station and Eastern Region, U.S.D.A.-Forest Service. 239 pp.

Mason, W.T.; C.T. Cushwa; L.J. Slaski; D.N. Gladwin; 1979. A procedure for describing fish and wildlife for Pennsylvania. U.S.D.I., Fish and Wildlife Service

III. THE FOREST PLANNING MODEL

A. Overview

The FOREst PLANning Model (FORPLAN) was the primary analytical tool used in the Forest planning analysis. FORPLAN is a series of computer programs which utilize a linear programming algorithm. This tool evaluates an extremely large number of management options on units of land and selects the combination which optimizes a chosen objective (usually Present Net Value). Because of the size and complexity of the Forest planning problem, the use of this computerized technique is very beneficial. Although it can analyze extremely large problems, it does have its limitations. The Forest's application of FORPLAN considered these limitations as well as the physical characteristics of the Forest in developing our FORPLAN model.

The most important aspects of FORPLAN are that it can:

- analyze very large problems,
- find the optimal solution to the problems, and
- find the most cost-efficient solution to the problems.

This solution is comprised of an allocation of prescriptions which define a particular management emphasis to land areas (analysis areas) and an associated schedule of inputs and outputs necessary to achieve the results. It also allows the Forest to quantify the trade-offs among the issues.

To use FORPLAN, the Forest's input-output relationships are depicted by mathematical equations. FORPLAN generated most of the equations, but the ID Team had to provide the variables of these equations, as well as the coefficients for them. These equations were applied to all analysis areas, each of which was fairly homogeneous with respect to productivity, response to treatment, and cost of treatment; and, at the same time provided some spatial aspect so that solutions could be implemented on the ground. The analysis areas also had to divide the Forest into units which allowed the Forest to address the planning problems.

Once the analysis areas were defined, the management prescriptions were identified. These defined alternative ways each analysis area could be managed to achieve different objectives.

The FORPLAN prescriptions cited sets of individual practices and their associated yields, costs, and benefits. These parameters provided the quantification needed for the analysis. Development of these parameters is discussed in Sections II-IV of this appendix.

With this framework, FORPLAN was able to determine the mix of prescriptions which optimized the desired objective. Since cost efficiency was an important aspect of the analytical requirements, this objective was generally specified as the "maximization of Present Net Value."

Different ways to address and solve selected combinations of problems had to be found because the planning problems contained numerous and often competing aspects. These combinations were defined by specifying objectives which limited the:

- prescriptions to be considered,
- output levels desired or permitted,
- acreages (where necessary to achieve a particular result),
- or prescriptions allowed in combination.

Objectives stated in this fashion became FORPLAN modeling constraints. The constraints provide the framework or limits within which FORPLAN must operate to determine a solution.

The solution is usually expressed in terms of the number of acres allocated by analysis area to each management prescription. A schedule of outputs is the result of applying those prescriptions over time. The allocation is translated (i.e., aggregated) into management areas which have a unique theme of management. Using FORPLAN also allows the Forest to qualify the trade-offs of the issues in the planning problems by examining the differences in inputs and outputs, and the overall present net value of different solutions.

The following FORPLAN program set was used to analyze all ANF plan alternatives and benchmarks:

FORPLAN, Version 2, Release 4.
FORPLAN, Version 2, Release 9.

The FORPLAN system is maintained at the USDA Fort Collins Computer Center (FCCC), Fort Collins, Colorado, and is comprised of programs to generate the matrix, solve the linear algorithms, and produce reports. The UNIVAC Functional Mathematical Programming System (FMPS) is used to solve the linear program and is also maintained on the FCCC UNIVAC 1100 mainframe computer.

B. Analysis Process

1. Analysis Prior to FORPLAN

In order to develop a FORPLAN model that was reasonable in size, that could be interpreted and understood, and yet enable us to analyze the planning problems, numerous assumptions, analysis, and decisions were made prior to actually running the model. Many of these assumptions and decisions were needed in order to define analysis areas, prescriptions, standards and guidelines, and other considerations which were basic input needed to develop the model. These pre-FORPLAN decisions often had the effect of limiting the range of choice or options that were available in the model, but we decided they were necessary to hold the model's size and cost to a reasonable and justifiable limit [commensurate with the resource]. Since FORPLAN was the primary analysis tool to assure cost-efficient alternatives, pre-FORPLAN decisions that had potential impacts on cost-efficiency were analyzed in more detail.

We completed major analysis and made decisions prior to FORPLAN modeling in the following categories:

- Limited Choices of Management Prescriptions on AA's Prices
- Analysis Area Delineators
- Non-FORPLAN Activities/Outputs
- Standards and Guidelines
- Determination of lands suitable for timber production
- Timber prescription economic analysis

a. Limited Choices of Management Prescriptions on AA's

We completed analysis in four areas which resulted in limiting options for management prescriptions:

- Options for Management Prescription 4
- Final harvest timing options in the regenerated timber yield tables
- Allocation of Management Prescription 8

For complete definitions of management prescriptions, see the Forest Plan.

1) Options for Management Prescription 4

We contracted a study (Strauss and Bowersox, 1982) to determine the anticipated costs, yields, and stumpage values we could expect from planting various species of conifers on various sites for the Allegheny National Forest. We also discussed the subject of planting significant acreages to conifers with the area's forest industry, and they showed little interest in a major conifer planting program. Based upon the conclusions of financial opportunities in Strauss' study, the uncertainty of markets, and lack of industry interest, we decided to limit the choice of Prescription 4 to 46,000 acres of the ANF:

- 20,000 acres of low stocking AA's,
- 16,000 acres of low site-index oak AA's, and
- 10,000 acres of the existing conifer stands.

Much of the acreage in these categories was identified in Strauss' study as providing the highest PNV opportunity if converted to conifers.

2) Final Harvest Timing Options in Regenerated Timber Yield Tables

When we began constructing the timber yield tables for FORPLAN, we wanted to have every age as a final harvest choice in regenerated yield tables. Because of the model size limitations and FORPLAN run cost-efficiency, we eliminated every other age (decade) as a potential final harvest timing option in the regenerated timber yield tables. Subsequently, FORPLAN model size limits were increased which allowed us to enter every age as a timing choice.

We made two FORPLAN runs to evaluate the effects of entering versus not entering the additional timing choices. We ran the Max PNV Benchmarks with and without the increased timing options and found:

- insignificant differences in total PNV,
- insignificant differences in harvest volumes in the early decades, and
- significant savings in FORPLAN computer costs in the run with "every other age" as an option.

The ID Team decided to perform the benchmark and alternatives analysis using every other age as final harvest timing options in the regenerated yield tables. No impacts on the cost-efficiency analysis were expected, but major computer cost savings occurred.

3) Allocation of Management Prescription 8 (Special Areas)

Because of their national or regional significance, we considered only management prescription 8 for:

- Tionesta Research Natural Area
- Kane Experimental Forest
- Tionesta Scenic Area

The Heart's Content area was considered only for prescriptions 8 and 5.

Because of their relatively small size, allowing other prescriptions would not significantly change results of the cost-efficiency analysis.

There are no intensity choices available within Management Prescription 8.

b. Prices

Prior to developing benchmarks and alternatives, we performed a sensitivity analysis and made decisions potentially affecting resource prices in two important areas:

- Real Price for Timber Outputs
- Assigned Values of RVD's and WFUD's

1) Real Prices for Timber Outputs

It was suggested that the Forest's assumptions on future real price changes would be a significant factor in establishing the economic optimum schedule and allocation. To evaluate this, the Forest analyzed historical trends in real prices for lumber over the last two decades for each species on the Allegheny National Forest (source: Hardwood Market Report, Appalachian Hardwood Section). Some species

showed significant increases while others showed significant decreases. We then grouped the species in the approximate proportions that they occur in our AA delineators, and found that Allegheny Hardwood (more than 25% cherry, ash, and poplar stocking) and high site oak analysis areas reflected a slight real price increase while Northern Hardwood (less than 25% cherry, ash, and poplar stocking) prices decrease. We decided not to include these calculated real price trends in our FORPLAN Analysis for 2 reasons: (1) the prices we used are an average of prices in the Appalachian Region, and may not accurately represent local trends and (2) Economists we consulted were skeptical that the trends we observed would continue. See the planning record for details of the analysis.

We considered using downward sloping demand. Neither results of the analysis of real prices, nor our discussions with the local forest industry suggested that downward sloping demand should be used within the range of harvests in our benchmarks and alternatives.

We decided not to vary the real prices of any species and not to use downward sloping demand.

2) Assigned Values of RVD's and WFUD's

In addition to the assumption on future stumpage prices, it was thought that the values assigned to the non-market outputs would be important in establishing the most efficient schedule and allocation. Since the assigned market values were not based on local transaction data, we tested the sensitivity of FORPLAN solutions to various levels of assigned values for RVD's and WFUD's. We made a variation on the Max PNV benchmark run using fifty percent of the RPA assigned values for WFUD's and RVD's. Allocations of the general management prescriptions and output levels did not significantly change between the runs but the selection of prescription intensities changed significantly. The Max PNV run chose all high investment intensities for recreation and wildlife, and the run which reduced assigned values selected nearly all low investment intensities. See the planning records for more detail of this analysis.

Because the allocation of general management prescriptions did not change significantly, we decided not to pursue local determination of value for non-market outputs. We used the 1985 RPA values for WFUD's and RVD's.

c. Analysis Area (AA) Delineators

To address ICO's and meet the cost-efficiency requirements of NFMA in our analysis, we initially thought we would require several more AA delineators than we eventually used in the analysis. Our first attempt to map AA's resulted in over 400 analysis areas. See the planning records, particularly the ANF's Sample Technical Package, for a description of the cost-efficiency analysis completed to assist in AA development.

Through a process using prototype models, early benchmarks, sample mapping their results, and analysis of the runs, we eventually used 96 AA's for the analysis. We believe this set of delineators provides an adequate representation of the land base to meet NFMA cost-efficiency requirements.

See III.C. for a discussion of AA development prior to FORPLAN.

d. Developed Recreation

Because of the specific spatial requirements of the developed recreation facilities, we did not include them in the FORPLAN model. Developed recreation strategies were determined through an iterative process including public involvement. The strategies range from providing small rustic recreation sites scattered across the Forest to an emphasis on highly developed resorts around the Allegheny Reservoir. Costs, outputs, and present net values were calculated for the developed recreation facilities selected for each alternative and added to FORPLAN results. The combination of facilities with the highest PNV was added to the benchmark results.

e. Determination of Lands Suitable for Timber Production

1) Land Suitability

Before beginning the FORPLAN analysis, we determined which lands were tentatively suitable for timber production in accordance with 36 CFR 219.14. First, all lands meeting the definition of forest land in 36 CFR 219.3 (land having or formerly having had at least 10 percent tree cover and not currently developed for non-forest use) were initially considered as suitable. With this definition a total of 30,866 acres of water, system roads, small wildlife openings, and rights-of-way are non-forest land. Next, all land designated by Congress, the Secretary, or the Chief for purposes that preclude timber production were classified as not suited (15,621 acres). In the final categories, the Allegheny National Forest has 450 acres of forest land not producing crops of industrial wood, 450 acres physically not suited for timber production, and zero acres with inadequate information concerning responses to timber management practices. The remaining acres are suitable for timber production and subject to FORPLAN analysis. Table B-1 displays the acres in each category.

Table B-1 Timber Resource Land Suitability

<u>Classification</u>	<u>low rec/wl Acres</u>
1. Water	8,305
2. Non-Forest Land ¹	22,561
3. Forest Land	479,664
4. Forest Land Withdrawn from Timber Production	15,621
5. Forest Land Not Producing Crops of Industrial Wood	0
6. Forest Land Physically Not Suited	
Irreversible Damage Likely to Occur	450
Not Restockable Within 5 yrs.	450
7. Forest Land-Inadequate Information ²	0
8. Tentatively Suitable Forest Land (Item 3 minus Items 4, 5, 6, and 7)	463,143

1 Acres in this category vary by alternative. The number displayed is for this current situation

2 Lands for which current information is inadequate to project responses to timber management.

2) Oil, Gas, and Mineral Development Timber Output Reduction

Another consideration on the Allegheny National Forest in determining acres of land suitable for timber production is the acreage removed from timber production by new and existing oil and gas development. Section IV.B.2. explains the demand scenario for oil and gas on the Forest.

Demand estimates will include not only the number of new wells, but also the new Acres Disturbed and new Acres Impacted in both High and Low Intensity developments. Acres Disturbed is defined as the acres actually cleared for well sites, roads, and related facilities, and indicates acreage temporarily taken out of timber production. Acres Impacted is the area within an oil/gas development plus a 200' surrounding perimeter where other resources or activities (wildlife, recreation, etc.) may be affected. Generally, one well and its road averages about 3/4 Acre Disturbed and Five Acres Impacted. Existing oil/gas wells and production are also part of demand and are included in the FORPLAN runs.

Oil and gas development is scattered throughout the analysis areas, taking land out of timber production where it occurs. Since it is so scattered, we have handled the timber production reduction by reducing timber volumes produced on each acre by a factor calculated from the forest-wide amount of oil and gas development land clearing, both existing and new. Under the High Demand scenario, this is a total of 32,684 acres cleared over 15 periods. Table B-8 shows the steady state reduction factors we used for each management prescription. The factor gradually changes over time until it reaches the number shown.

f. Timber Prescription Economic Analysis

The Forest Planning Regulations (36 CFR 219.14) require us to analyze timber resource land suitability. There are several stages to this analysis. The first stage (219.14(a)) identifies lands not suited for timber production. The results of this stage were presented in Section III.B. of this appendix. For lands other than those that were identified as not suited, an assessment of the costs and benefits for a range of management intensities for timber production had to be made (219.14(b)). This assessment, identified below, includes only the direct costs and benefits of timber production. The third stage (219.14(c)) consists of identifying lands which are not appropriate for timber production in order to meet objectives of the individual alternatives being considered. The results of this third analysis are summarized in Table 4-25 of the Final EIS.

Before we began our formal analysis process, we completed an economic analysis (known as the Timber Financial Analysis) of all of the timber management prescriptions we intended to use in FORPLAN. First, we identified the costs and benefits related to timber production for each prescription. The costs we included are the element E costs displayed in Table B-10. The benefits are those displayed for element E in Table B-12, except we did not include the Big-Game WFUD Benefits. Next, we calculated the present net value of each timber intensity and each timing option. Present net value equals the excess, over the 150-year planning horizon, of discounted benefits less discounted costs. Those timber management intensities which yield a positive PNV show direct benefits from timber production which exceeds direct costs.

Analysis Process

As a result of this analysis, we now know which analysis areas yield positive returns for timber management and the timber management strategy which yields the highest PNV on each. The planning records contain detailed information on the results of the timber financial analysis for each analysis area.

Here is brief summary of Timber Financial Analysis Results for Management Areas 1, 2, 3, 4, 6.1, 6.2, and 6.5. It shows that Management Areas 3/6.1 yield the highest present net value (PNV) for timber management. The PNV for timber harvesting in Management Areas 3/6.1 is positive for all timber management intensities on all analysis areas except the following:

all timber harvesting on low stocked analysis areas which are older than 30 years;

thinning intensity on Northern hardwoods, 1-30 age class, with medium stocking;

precommercial thinning intensity on high site oak analysis areas, which are in the 1-30 age class;

all timber management intensities on low site oak for the 1-30 age class.

The PNV's for Management Area 1 are negative on all analysis areas.

The PNV's for Management Area 2 are positive only on the following analysis areas:

all Allegheny hardwoods;

all Oak analysis areas older than 70 years;

all high site oak on the gentle slope LTA's in the 31 to 70 age classes;

all Northern hardwood analysis areas older than 70 years;

all well-stocked Northern hardwood analysis areas in the 31 to 70 age classes.

Management Area 4 is an option on low site oak and low stocked analysis areas. The PNV's for timber management are positive on all low site oak analysis areas, except the 1-30 class, and are negative on all low stocked analysis areas.

Management Area 6.2 was applied to all but low stocked analysis areas. Where applied, PNV's for Management Area 6.2 are always negative on analysis areas with the following characteristics:

- all Northern hardwoods, 1-30 age class, with medium stocking;

- all high site Oak, 1-30 age class, on plateaus;

- all low site Oak, 1-30 age class.

All other analysis areas have positive PNV's for Management Area 6.2.

The PNV's for timber harvesting in Management Area 6.5 are negative for the following analysis area characteristics:

- all low stocked analysis areas;

- all Northern hardwoods with medium stocking;

- all Northern hardwoods with high stocking greater than 90 years.

The remaining PNV's are positive with the greatest PNV being \$94 per acre on medium and high stocked Allegheny hardwoods in the 1-30 year age class.

The NFMA regulations 36 CFR 219.14(b) require the Forest to "...identify the management intensity for timber production for each category of land which results in the largest excess of discounted benefits less discounted costs...". Table B-2 makes this summary by analysis area grouping. The only analysis area grouping always having a negative PNV for timber management is low stocked Allegheny and Northern hardwoods on plateaus and gentle slopes in the 31-90 age class.

Table B-2 Management Intensity Having Greatest PNW Per Acre
(Discounted Timber Benefits minus Discounted Timber Costs)
By Analysis Areas Groups

<u>LTA</u>	<u>Timber Type</u>	<u>Age</u>	<u>Stocking Site Index</u>	<u>Rx</u>	<u>Intensity</u>	<u>PNV (\$)</u>
P,G	AH/NH	<30	<45	3	F-IF	31-32
P,G	AH/NH	31-90	<45	6.5	Uneven-aged	-11
P,G	AH	<30	45-74	3	FH-FH	97-99
P,G	AH	<30	>75	3	2PIIF	150-156
P,G	AH	31-110	45-74	3	FH-FH	230-1071
P,G,S,B	AH	31-70	>75	3	IIF14P	284-670
S,B	AH	71-110	>75	3	FH-FH	602-1267
P,G	AH	71-90	>75	3	FH-FH	615-623
G	AH	>90	>75	3	IIF14P	1320-1974
P,G,S,B	AH	All Ages	>45	3	FH-FH	2-865
P,G	Oak	<30	>65	3	FH-FH	12-13
P,G*	Oak	31-50	>65	3	FIF2J	94-96
P,G,S,B	Oak	51-90	All Sites	3	FH-FH	105-572
P	Oak	91-110	>65	3	FH-FH	520
P,G,S,B*	Oak	>91	>65	3	4JFIF	863-1656
G	Oak	<30	<65	6.5	Uneven-aged	8
G**	Oak	>111	<65	4	Red Pine	896

* Conversion from Oak to Allegheny hardwoods

** Conversion from Oak to Red Pine

PNV's by individual management intensity and analysis area are in the process records.

2. Use of FORPLAN

Two important aspects of the Forest Plan analysis are the assignment of management prescriptions to land areas and the resource output scheduling. FORPLAN is capable of simultaneously determining both the allocation and the schedule. The FORPLAN model was designed so that each problem statement in Appendix A could be analyzed.

The first problem statement asks what mix of recreation opportunities and setting should be provided on the ANF to best satisfy the diverse preferences of recreationists. Each prescription in the FORPLAN model was given a per-acre coefficient which calculates the RVD's per acre by ROS class. Each RVD was valued based on it's ROS class and the 1985 RPA values for RVD's. This allows modeling of RVD's or acres by amount or proportions in each ROS class or ROS class.

The second problem statement addresses the concern of what quantity of timber volume the ANF should produce. Characteristics in the FORPLAN model which can be used to address this problem are: 1) analysis area identifiers, such as timber type, stocking, and age, 2) management prescriptions, both even and uneven-aged, 3) multiple timber outputs of hardwood sawtimber and pulpwood and softwood sawtimber and pulpwood, and 4) variations in timber values by all of the above. By placing restrictions on various combinations of the characteristics mentioned above the FORPLAN model can be used to evaluate the alternative methods of addressing the problem statement.

The third problem statement to be addressed in the planning process is how the ANF integrates oil and gas operations with management of surface resources while minimizing environmental effects. Five management prescriptions estimating the effects on activities, outputs, costs, and returns on areas of high OGM development were developed and entered into the FORPLAN model. Each AA was required to receive a certain number of acres of these goals based on estimated OGM development and the potential of OGM development on each AA. Using FORPLAN the effects of various levels of OGM development on the ANF could be measured.

The final problem statement to be addressed is the amount of Wilderness the ANF should recommend. A management prescription was developed to estimate the costs and yield of managing an area as Wilderness. This management prescription can be applied on any acre or acres of the ANF and effects of Wilderness management can be evaluated.

3. Analysis in Addition to FORPLAN Analysis

a. Transportation Planning

An intensive transportation planning analysis was done after we completed the FORPLAN analysis. In order to ensure the cost-efficiency requirements of NFMA, the FORPLAN results involving allocation and scheduling of timber harvests are needed before we develop the transportation plan.

b. Small, Non-Game, and Fish WFUD's

Small and non-game WFUD's and fishing WFUD's values were not included in FORPLAN because of the complexity of modeling their yield responses to management practices, and their relative numbers compared to big-game WFUD's. Amounts of small and non-game WFUD's were calculated after the FORPLAN runs were made for each benchmark and alternative.

c. GA and Program Management

GA and program management were not included in the FORPLAN analysis because their size depends upon the levels of goods and services produced in the resource elements. Cost estimates, then, were developed for GA and program management as non-linear functions of the resource elements' levels of activities and outputs. See the planning record for details on these cost estimates.

d. Spatial Feasibility Analysis

FORPLAN analysis does not account for the spatial requirements or distribution needs of all activities modeled. During the early benchmark runs some spatial feasibility tests were made on the major prescriptions. From this, adjustments were made to the FORPLAN model to account for some spatial needs. To further insure spatial feasibility, field personnel reviewed the draft management area maps of each Alternative and made final adjustments.

e. Management Area 6.1 Wildlife Element Timber Harvests

Following the review of the public comments on the draft documents, we adjusted management prescription 6.1. The adjustments more clearly explain and model those vegetative treatments, which will benefit featured wildlife species. First, we more clearly discussed vegetation manipulation in the standards and guidelines for Management Area 6.1 in the Forest Plan. Second, the draft documents did not include any estimate of timber activity or yield which would result from final harvests, thinnings, or selection cuts. We calculated these outside of FORPLAN for Management Area 6.1 using average per acre FORPLAN costs and yields from Alternative D as a guide. Then we added these to the forest-wide summaries in all of the planning documents and to the summary for Management Area 6.1 in the Forest Plan.

C. Identification of Analysis Areas

Analysis areas (AA's) are the basic land allocation unit within FORPLAN. Selection of the set of AA's eventually used in the analysis evolved through an interdisciplinary effort. The initial list of delineators chosen by the ID Team resulted in over 400 AA's. Through a series of aggregations of small AA's (100 acres) and reducing the number of delineators to only those judged most significant to the analysis problems, the ID Team settled on 96 analysis areas. The final set of delineators evolved through the actual development of prescriptions and subsequent analysis of initial FORPLAN test runs and benchmarks.

Delineators were changed or deleted if they were not used in prescription cost or yield development, if their effect on the results were judged insignificant, or if the problem they related to could be modeled more efficiently another way.

Table B-3 lists the final set of delineators and their acreages.

Table B-3 Final Analysis Area Delineators

<u>Delineator</u>	<u>Acres</u>	<u>% of Land Base</u>
Land Type Groups		
Plateau	192,000	38
Moderate Slope (less than 40%)	275,000	55
Steep Slope (greater than or equal to 40%)	27,000	5
Bottomland	8,000	2
Timber Types		
Allegheny Hardwoods	309,000	61
Northern Hardwoods	92,000	19
Oak	102,000	20
Timber Age		
1-30 years	23,000	5
31-50 years	31,000	6
51-70 years	228,000	45
71-90 years	190,000	38
91-110 years	27,000	6
111+	3,000	1

Table B-3 (con't) Final Analysis Area Delineator

<u>Delineator</u>	<u>Acres</u>	<u>% of Land Base</u>
Timber Stocking/Site Index		
Allegheny and Northern Types		
Low Stocking (0- 44%)	20,000	4
Medium Stocking (45- 74%)	64,000	13
High Stocking (75-100%)	317,000	63
Oak		
Low Site Index (<65)	16,000	3
High Site Index (≥65)	86,000	17

Land Type Groups

In 1973, Wayne E. Humbert (U.S. Forest Service) described, defined, and mapped land-form groups within the Allegheny National Forest. These land form or landtype groups include Plateaus (P), Slopes (S), and Bottomlands (B). (General Soil Inventory of the Allegheny National Forest - Humbert, 1973)

Land type groups represent broad ecological characteristics. Thus, some cost and yield differences caused by ecological factors will be represented in the model.

When overlaying delineators to form analysis areas, this layer was the base layer to which all other delineators were added. Boundaries of the land type groups will not be altered when other layers are added.

The slope land type group is separated at 40 percent because this is the point where special harvesting and roading precautions need to be employed and visual quality is typically sensitive.

Timber Types

Allegheny hardwoods, Northern hardwoods, and Oak represent over 95 percent of the forest. The remaining types, such as conifer and aspen because of their low market values and small acreages, will be treated as inclusions in the three timber types.

The Allegheny hardwood type is actually a subset of the Northern hardwood type with greater than 25 percent component of cherry, ash, and tulip poplar (CAP's). Because of their high commercial value, the percent CAP's is an important variable in estimating the yield and value of Allegheny hardwood stands.

Timber Age

Six categories will be used to identify beginning ages of the analysis areas. Age categories were selected using two criteria:

- delineate areas where treatments may be options early in the planning horizon versus those where treatments would be options later in the planning horizon.
- use age categories which delineate areas of differing amounts of wildlife user days.

Zero to thirty years identifies young growth where no commercial treatments take place early in the planning horizon, and provides for significant yields of certain wildlife species. Thirty-one to fifty describes areas where generally there are no treatments. Fifty-one to seventy, seventy-one to ninety; and ninety-one to one hundred ten identify AA's where various thinning and final harvest options may take place as well as various changes in wildlife species and yields. The sixth age class of 111+ identifies areas for final harvest as well as defining "old growth" for wildlife yield estimation.

Timber Stocking

High and medium stocking levels identify Allegheny and Northern hardwood analysis areas where thinning prescriptions will be options and low stocking identifies failed clearcuts and savannah stands where planting will be an option. Stocking also explains significant stumpage value differences.

Site index is used to separate oak stands into two levels that relate to significant differences in value.

The following sections summarize the major factors affecting the delineation.

1. Economic factors

Significant changes in value influenced the selection of the timber type and stocking delineators.

Major increases in costs based on topography of certain common management practices, such as road building and sale prep, influenced the choice of LTA slope delineator categories.

2. Inventory and Data Reliability

Data reliability generally had little effect on the final selection of analysis area delineators. Data availability though did effect our initial choice of delineators. The ID Team searched for a delineator showing where the timber regeneration problem of fern and striped maple existed. Mapped forest-wide information in this understory problem was not available. We have recognized this as a priority data collection need for future plan revisions.

In attempting to identify a basic capability unit or resource layer that relates to biological response, the ID Team sought an Ecological Land Type (ELT) classification system for the Forest. A study in 1981, Ecological Land Typing and Field Measurement Analysis indicated that existing data could not be used to develop a meaningful ELT. The ID Team therefore chose to use a broader ecological classification level - the land type group. At this time the biological response (yields and values) is more predictable based on the type, stocking, and age delineators.

3. Computer Model Characteristics

Limits in FORPLAN software and FCCC hardware had an influence on our delineation of AA's. The model actually allowed more detail than the ID Team desired. If anything, it was the cost of making runs that had the greatest effect. Since cost increases as the number of analysis area and prescription combinations increase, the ID Team reduced the number of analysis areas to the fewest possible.

Also, our ability to comprehend and analyze the results improved with fewer analysis areas and prescription combinations. So it was cost and human skills that influenced particularly the total number and definition of analysis areas and not the model requirements.

4. Reporting Needs, Policy Constraints

These factors did not effect the delineation of analysis areas. Such needs as reports by District and evaluation of tradeoffs for each RARE II area will be done from the results of each run. Such spatial information was not necessary in the model to address the planning problems.

5. Spatial Factors vs. Biological

The spatial criteria of size and distribution influenced the final delineation of AA's. The smallest individual areas to be mapped were capability units. These areas were defined as being at least 20 acres in size and were aggregated into forest-wide AA's containing a minimum of 100 acres. Small inclusions such as aspen, conifer, steep slopes, spring seeps, riparian areas are a common characteristic of many analysis areas. These inclusions have been accounted for in the yield tables and cost calculations as well as in the standards and guidelines.

D. Identification of Prescriptions

1. Overview

a. Management Prescription Definition

National Forest Management Act Regulations define management prescriptions as "management practices selected and scheduled for application on a specific area to attain multiple-use and other goals and objectives." Generally, a management prescription is a set of treatments or practices needed to create a desired forest condition and produce specified outputs, while also protecting all resource values to established standards.

b. Criteria Used in Developing General Prescriptions

During the development and review of the general Management Prescriptions, the Allegheny National Forest Interdisciplinary Team and Management Team (District Rangers and Staff) prepared and revised the general Management Prescriptions using the following criteria:

- 1) Does the prescription adequately communicate the long-term desired land condition?
- 2) Will the prescription provide the technical management direction needed by a land manager to achieve the stated future condition?
- 3) Is the prescription written specifically enough for us to develop standards and guidelines consistent with its overall purpose and intent?
- 4) Does the prescription provide enough detail to enable us to develop FORPLAN costs and yields? Have we identified all of the decision variables and significant MIH activities required to produce the desired land condition?
- 5) Has the Allegheny National Forest responded to all of the Regional Prescriptions which are appropriate here?
- 6) Do the prescriptions provide a wide enough range of land conditions for us to adequately respond to the Problem Statements and the Issues, Concerns, and Opportunities included therein?

Identification of Prescriptions

c. Description of the Prescription Development Process

The Allegheny National Forest established an Interdisciplinary Team (ID Team) to develop the management prescriptions. The permanent Supervisor's Office (SO) members of the team were all assigned full time to Land Management Planning. This group made the first draft of the general management prescriptions. Next, the Forest established an ID Team composed of four District personnel. This team assembled periodically throughout the process when specific field input was required for the prescriptions. Staff specialists periodically provided additional input into the prescription development process.

The management prescription development process began with the ID Team reviewing the planning problems to determine the different outputs, conditions, or other benefits the public had expressed a need for the Allegheny National Forest to provide. Basically this consisted of a review of the Problem Statements and the Issues, Concerns, and Opportunities contained therein. Following this determination, the ID Team developed a set of potential land conditions to address or respond to the Issues, Concerns, and Opportunities within each planning problem. The description of the possible land conditions included such items as desired timber types, road densities, silvicultural systems, recreation opportunities, and outputs produced or emphasized.

After describing each desired condition response for each planning problem, the ID Team grouped the desired conditions which emphasized the same outputs, provided the same land conditions, responded to the same issues and concerns, or provided a similar response to conditions described in the Regional Management Prescriptions. The resulting set of desired land conditions became the Allegheny National Forest general Management Prescriptions.

The ID Team then began to develop the Standards and Guidelines for each Management Prescription through consultation with the Staff Specialists and members of the District ID Team. These Standards and Guidelines (S&G's) provide the specific resource direction needed to obtain the desired conditions in the management prescriptions and to implement each prescription on-the-ground, and they help establish the basis for the detail included in the FORPLAN prescriptions. Finally, they provide much of the direction needed to ensure projects will meet the minimum management requirements specified in 36 CFR 219.27. Section VI.B. of this Appendix provides additional detail regarding the Minimum Management Requirements. The SO and District ID Teams had to determine the most efficient and effective method to achieve these requirements and used one or a combination of the following techniques:

- Standards and Guidelines
- Constraints
- Project Development
- Monitoring
- Analysis of spatial feasibility of prescriptions
- FORPLAN analysis

For those MMR's most efficiently dealt with through the FORPLAN analysis or the Standards and Guidelines, the ID Team relied heavily on both our professional experience in dealing with these requirements as well as available research, particularly research completed by the Northeast Forest Experiment Station in Warren, Pennsylvania. The following is a brief summary of the criteria we employed to deal with MMR's in the prescriptions:

- Base the response on the most cost-effective method of meeting the objective.
- Provide some choice in the FORPLAN model related to MMR's. For example, activities (and their associated costs) required to meet MMR's vary between analysis areas, though there is no variation within a given prescription on a specific analysis area. Activities required to meet MMR's may also vary by prescription (2 has different activities to meet MMR's than does 3). FORPLAN then picks the most efficient prescriptions for each alternative.

Identification of Prescriptions

- The specific timber management activities included in the prescriptions to meet MMR's are based on research conducted on the Forest as well as professional experience. These activities vary by timber type.
- Many of the MMR's are met through MIH coordination activities for projects based on professional experience. Recreation and wildlife coordination activities for timber sales, for example, include the most effective and cost-efficient methods developed to date.

Each general prescription also contains different management intensity or investment levels and different timing options for the scheduling of management activities. These provide FORPLAN with a wide range of scheduling choices. The management intensities allow us to respond to increased resource demands and change budget levels without having to make major changes in the general prescription assignments. Section III.D.1.d. provides additional detail regarding intensities and timing options.

Once the ID Team completed the initial set of Management Prescriptions and Standards & Guidelines, they presented them to the ANF Management Team and the Regional Forester for approval. Both review levels recommended some changes. The District ID Team then completed the revisions. Since the Management Prescriptions represented the range of choice to respond to the issues and concerns within the planning problems, the Forest next presented them to the local public for their review and comment. Following these reviews the ID Team and the Staff Specialists completed a final revision to add more detail to the Standards and Guidelines which would aid in more completely describing the desired land condition, activities, or outputs expected. The Forest Plan contains the full set of the general Management Prescriptions (2, 3, etc.) and their respective Standards and Guidelines.

d. FORPLAN Prescription Development Process

The general Management Prescriptions provided the framework for developing the FORPLAN prescriptions. The FORPLAN prescriptions contain much more detail than the general prescriptions. They reflect many of the specific activities required to produce the desired land condition and specific outputs called for by the general

prescription. Those activities/outputs which we could not model in FORPLAN, we added through analysis completed outside FORPLAN. In order to provide FORPLAN a wide range of options to meet the scheduling requirements and analyze cost-efficiency, the ID Team developed specific FORPLAN prescriptions within each general prescription which reflected different management intensities and different timing choices. The ID Team, however, did not include all Management Prescriptions in the FORPLAN model. The following discussion provides additional detail.

1) Criteria Used to Select Prescriptions to Model in FORPLAN

The ID Team did not include prescriptions for riparian areas, developed recreation, or special areas in the model. The following questions or criteria played an important role in making this decision.

- Would it significantly increase scheduling options or improve cost-efficiency analysis in the FORPLAN model?
- Does the prescription apply to small acreages which have significant spatial requirements, or site specific costs and yields?
- Can we exclude the prescription and, thereby, reduce FORPLAN analysis costs without significantly reducing the quality of our analysis?
- Does the prescription apply to a wide range of Analysis Areas (AA's) or to only a select few? Will we allow the prescription to be chosen on large acreages encompassing many AA's?

2) Implications of Including/Excluding Prescriptions in the ANF FORPLAN Model

We have included most of our prescriptions in the FORPLAN model. This provides a wide range of options for scheduling choices on an AA and between AA's at various levels of investment. Prescriptions for riparian areas, developed recreation, and special areas

will be analyzed outside of FORPLAN and added to the FORPLAN results. Non-FORPLAN analysis works best for these areas since their acreages are small and spatial arrangement is critical.

3) Timing Choices

a) Timber

The timber timing choices available for regeneration harvests in the FORPLAN prescriptions are within the range defined as the point where the Analysis Area reaches 95 percent of culmination of mean annual increment (CMAI) and a point which provides old growth conditions. All even-aged management prescriptions (except aspen management) have a final harvest option at least as old as 150 years. For those alternatives where we examined the effects of long rotations, the oldest rotation age for each analysis area is 200 years. Aspen is an exception to the above. It may be harvested before 95 percent CMAI in order to provide optimum grouse habitat, and we have not carried it past 70 years.

In order to keep the model from becoming unnecessarily large and expensive to run, we deleted every other rotation age in the yield tables for regenerated vegetation, but we kept every one in the yield tables for existing vegetation. This decision was based on our analysis which showed no significant changes in PNW or the allocation when we used every other rotation in the regenerated stand. Detailed findings of this analysis can be found in the planning records in a 1920 memo, dated February 13, 1984, entitled "Timing Options in FORPLAN".

To provide adequate opportunities for the thinning choices, many analysis areas which can support a thinning or selection cut in the first decade also have a prescription which delays that first entry thinning until period 2.

Selection cuts occur on a 20-year cycle for every intensity in management prescriptions 2 and 6.5. The age of the first entry is 60 years, with analysis areas older than 60 years requiring a series of cuts 20 years apart to bring them into an uneven-aged condition. In management prescription 2, each analysis area has the option of waiting until age 70 for the entry of the 20-year cycle.

Table B-7 shows the rotation age ranges in FORPLAN for timber types, and Table B-6 displays initial entry ages for thinnings and selection cuts.

b) Wildlife

Timing choices for wildlife are an integral part of the intensities (described below). Wildlife habitat development occurs in different amounts and at different rates based on the level of intensity selected.

c) Recreation

Recreation timing options relate to the decade when the trail building occurs. The Low Intensity includes no new trails. The Medium Intensity calls for an equal number of miles of new trail in each of the next four decades. The High Intensity reflects equal amounts of new trail construction in decades 1 and 2, but 20-30% more in decades 3 and 4.

4) Management Intensities

Management intensities within each prescription provide additional options for cost-efficiency analysis in the FORPLAN model. Intensities represent the combination of investment levels, timing of investments, and choice of practices to achieve different levels of output quantity and quality within the theme of a Management Prescription. Desired land conditions and output levels for a prescription are expressed as a range on a continuum between upper and lower acceptable bounds. Points on this output continuum require different investment levels which we have defined as management intensities. Intensities then have a direct effect on production levels and the quality of the product or experience.

Because each prescription has the potential to produce a wide range of intensity options, we limited the choices in the model to a practical number. We narrowed the number of intensities using an interdisciplinary process. Here, we examined trade-offs, cost-effectiveness, similarity to other choices, our knowledge of the resource response to investments, and the potential significance of the prescription on the Forest. The result was that we modeled numerous intensities for some prescriptions and only one for others (see Table B-5 for additional details).

a) Timber Intensities

First, we established those activities required in the prescriptions to meet Minimum Management Requirements (MMR's). The activities are based on research, cost-effectiveness, and our professional experience with regenerating stands. Each intensity within prescription 3, for example, includes the activities we have found to be most cost-effective and biologically sound in regenerating each timber type. We have not included alternative techniques in the model for regenerating a particular timber type managed under prescription 3.

Each prescription on each timber type which calls for even-aged management includes an additional allowance for regeneration costs to cover a second round of regeneration activities on a small percentage of each acre where the first treatment fails to adequately regenerate the stand. These percentages are based on historical failure rates experienced on the Forest over the last few years.

Next, we established those timber management activities which we could logically vary to produce different management intensities on a given Analysis Area. These are basically the investments or activities which change the quantity or the quality of the yield on each acre. For Management Prescription 3, this resulted in the following general intensities:

- Intensities which include precommercial and commercial thinnings,
- Intensities which include commercial thinnings,
- Intensities which include only regeneration harvests (no intermediate treatments),

- Intensities which allow type conversion from oak to Allegheny hardwood,
- Intensities which provide for planting existing low stocked Analysis Areas with Allegheny hardwoods.

Table B-5 displays the timber intensities for each general prescription which we developed for each Analysis Area.

b) Recreation Intensities

We developed three intensities which vary by quantity and quality of trail building and dispersed recreation management.

- Low Intensity is defined as maintaining current investments. We would maintain the existing trail system and would not develop any new trails. This is the low end of the range described in the Standards and Guidelines.
- Medium Intensity is mid-way between Low and High Intensity. Equal amounts of trails are built in each of the first four decades.
- High Intensity is the upper limit of the range described in the Standards and Guidelines. We established the upper limit on trail densities for each prescription by examining the Recreation Opportunity Spectrum (ROS) class called for therein and determining the maximum trail density consistent with maintaining that ROS classification. Equal amounts of new trail construction occur in decades 1 and 2, and 20%-30% more in decades 3 and 4.

c) Wildlife Intensities

We developed three wildlife intensities, which vary by quantity and quality of wildlife habitat development. Our process records contain additional details.

- Low Intensity, as for recreation, maintains current investments with no new habitat development. The wildlife opening objectives for each management area are the following:

Management Areas 1, 2, 4, 6.2	= 1%
Management Areas 3, 6.1	= 2%

- Medium Intensity is mid-way between Low and High Intensity. All new wildlife habitat development occurs within the next 30 years. The wildlife opening objectives for each Management Area are the following:
 - Management Areas 1, 2, 4, 6.2 = 2%
 - Management Areas 3, 6.1 = 5%
- High Intensity conforms with achieving the upper limit of the featured species population range described in the standards and guidelines. These upper limits are consistent with those specified in recent research literature, modified slightly based on our professional knowledge of local conditions. All new wildlife habitat development occurs within the next 20 years. The wildlife opening objectives for each management area are the following:
 - Management Areas 1, 2, 4, 6.2 = 3%
 - Management Area 3 = 8%
 - Management Area 6.1 = 9%

d) Recreation, Wildlife, and Timber Intensity Combinations

Combining the separate timber, recreation, and wildlife intensity options available for each general management prescription produces a wide range of multiple resource management intensities therein. For example, for management prescription 3 on a high site oak analysis area, High, Medium, or Low recreation can be combined with High, Medium, or Low wildlife and any of the four timber intensities. We limited them to a more workable number by merging the recreation and wildlife intensities into three intensities: High (HI), Medium (M), and Low (L). High includes the High Intensities for both recreation and wildlife, Medium includes the Medium Intensities for both, and Low includes the Low Intensities for both. It does not seem appropriate to include other combinations of the recreation/wildlife intensities (low recreation - high wildlife, medium recreation - low wildlife, etc.) since these types of resource uses are complimentary. Wildlife use is essentially another form of recreation use, and wildlife users occupy many of the developed and dispersed recreation facilities while using the Forest. So we reduced recreation/wildlife from 9 possible combinations down to three which we included in FORPLAN. We did not merge the intensities any further because we wanted

timber and recreation/wildlife to function independently in the intensity selection process. So FORPLAN can choose any of the three recreation/wildlife Intensities to go along with each of the timber intensities. For a hypothetical example, if prescription 3 has three recreation/wildlife intensities and five timber intensities, it will have 15 total intensity combinations. Table B-5 identifies the intensities available in the FORPLAN model for each management prescription.

e. Oil and Gas Development Intensities

Oil and gas development has two management intensities - High and Low. We have handled them a little differently than the recreation/wildlife/timber intensities; for OGM, the intensities differ at the broad prescription level. We developed five high intensity oil and gas development prescriptions after carefully examining the land condition and outputs called for in each of the rest of the prescriptions (1, 2, 3, 4, 5, 6.1, 6.2, 6.3, 6.4, 6.5, 7, 8, and 9.1). We have defined a high intensity of oil and gas development as one having five or more wells with a spacing of 450 feet to 1,000 feet between wells. Anything with less than five wells and with a spacing of more than 1,000 feet is low intensity development. If we felt we could still retain a significant portion of the general theme of the prescription in a high intensity oil and gas development, we developed a similar prescription but with a high oil and gas production emphasis (1.11, 2.21, 3.41, 4.01, 9.11). Each of these retains as much of the parent prescription's emphasis as possible. Low intensity development can occur in many of the other prescriptions.

So, how do the two OGM intensities relate to timber and recreation/wildlife intensities? In the management prescriptions which permit either low intensity or no oil and gas development (1, 2, 3, 4, 5, 6.1, 6.2, 6.3, 6.4, 6.5, 7, 8, 9.1), all of the timber and recreation/wildlife combinations implied on Table B-5 apply. In the high intensity OGM prescriptions (1.11, 2.21, 3.41, 4.01, 9.11), all of the timber intensities apply, but only the low recreation/wildlife intensity is valid. From experience we have found intensive recreation or wildlife management is not appropriate where oil production activities dominate the immediate environment.

Identification of Prescriptions

f. Process Followed to Ensure an Adequate Range of Prescriptions

The previous Section III.D.1. (pages B-39 to B-42) discusses what the ANF did to ensure an adequate range of prescriptions.

2. Purpose, Criteria, and Assumptions for Each Category of Prescription

The following pages in this section contain a brief description of each general Management Prescription. These respond to the Regional Management Goals which have the same first digit.

Table B-5 displays a list of all the prescriptions and their management intensities.

a. Management Prescription 1

This prescription emphasizes providing early successional species of forest vegetation, primarily aspen, managed on a short rotation to increase hunting opportunities in a roaded environment.

1) Purpose

- Provide wildlife habitat though timber management which emphasizes producing small, early successional, hardwood trees for fiber or lumber on a 40-year rotation.
- Emphasize grouse and deer production.
- Provide a roaded natural recreation setting with all types of dispersed recreation opportunities, but particularly emphasizing hunting.

2) Criteria Assumptions, and Economic Considerations

- This prescription is a choice on all analysis areas where aspen stands now exist.
- Since we have a poor market for pulpwood products, prescription 1 includes both a commercial intensity (timber sale) and a non-commercial intensity (bulldozing) which can be used to regenerate the Analysis Areas.

b. Management Prescription 1.11

This prescription emphasizes providing early successional species of forest vegetation, primarily aspen, managed on a short rotation to increase hunting opportunities in a setting dominated by intensive oil and gas development.

1) Purpose

- Provide wildlife habitat through timber management which emphasizes producing small, early successional, hardwood trees for fiber or lumber on a 40-year rotation.
- Emphasize grouse and deer production.
- Emphasize hunting within a roaded natural recreation setting.
- Manage high intensity oil and gas development on outstanding, reserved, and USA mineral ownerships.

2) Criteria Assumptions, and Economic Considerations

- This prescription is a choice on all analysis areas.
- Since we have a poor market for pulpwood products, prescription 1.11 includes both a commercial intensity (timber sale) and a non-commercial intensity (bulldozing) for regenerating the Analysis Areas.
- Many forms of dispersed recreation are not compatible with high intensity oil and gas development.

c. Management Prescription 2

In this prescription the forest will generally have a continuous crown canopy consisting primarily of shade tolerant vegetation with interspersed small openings and associated wildlife.

1) Purpose

- Provide a continuous, forested scene through practicing uneven-aged management which will promote tolerant species and produce quality sawtimber.

-
- Feature wildlife species associated with shade tolerant vegetation, primarily songbirds and cavity nesting birds and mammals.
 - Provide the opportunity for a variety of developed and dispersed motorized recreation opportunities in a roaded natural setting.

2) Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on all analysis areas.
- Under 2, areas where the vegetation consists predominantly of intolerant species will gradually move toward a more shade tolerant species composition and lower timber values.

d. Management Prescription 2.21

This prescription emphasizes providing a forest with a continuous crown canopy broken primarily by the roads and openings associated with intensive oil and gas development.

1) Purpose

- Provide a continuous forested scene through practicing uneven-aged management which will promote tolerant species and produce quality sawtimber.
- Feature wildlife species associated with shade tolerant vegetation, primarily songbirds and cavity nesting birds and mammals.
- Emphasize hunting within a roaded natural recreation setting.
- Manage high intensity oil and gas development on outstanding, reserved, and USA mineral ownerships.

2) Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on all Analysis Areas.
- Under 2.21, areas where the vegetation consists predominantly of intolerant species will gradually move toward a more shade tolerant species composition with lower timber values.

- Many forms of dispersed and developed recreation are not compatible with high intensity oil and gas development.
- Recreation and wildlife management will be Low Intensity.

e. Management Prescription 3

This prescription emphasizes providing a forest which is a mosaic of predominantly hardwood stands and associated understories that provide habitat for game and non-game wildlife species. Each stand will consist of trees of approximately the same age and height.

1) Purpose

- Provide a sustained yield of high-quality Allegheny hardwood and oak sawtimber through even-aged management.
- Provide a variety of age or size class habitat diversity from seedling to mature sawtimber in a variety of timber types.
- Emphasize deer and turkey in all timber types and squirrel in the oak type.
- Provide a roaded natural setting for all types of developed and dispersed recreation opportunities, with an emphasis on motorized recreation activities.

2) Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on all Analysis Areas.
- Prescription 3 contains a wide variety of management intensities.

f. Management Prescription 3.41

This prescription emphasizes providing a forest composed of a mosaic of hardwood stands and associated understories that provide habitat for game and non-game wildlife species in a setting dominated by intensive oil and gas development.

1) Purpose

- Provide a sustained yield of high-quality Allegheny hardwood and oak sawtimber using even-aged management.
- Provide a variety of age or size class habitat diversity from seedling to mature sawtimber in a variety of timber types.
- Emphasize deer in all timber types and squirrel in the oak type.
- Emphasize hunting within a roaded natural recreation setting.
- Manage high intensity oil and gas development on outstanding, reserved, and USA mineral ownerships.

2) Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on all Analysis Areas.
- Many forms of dispersed and developed recreation are not compatible with high intensity oil and gas development.
- Recreation and wildlife management will be Low Intensity.

g. Management Prescription 4

This prescription emphasizes providing a forest which is a mosaic of conifer stands and associated understories that provide habitat for game and non-game wildlife species. Most of the trees within a stand will be of the same size and age.

1) Purpose

- Provide a sustained yield of softwood sawtimber using even-aged management.
- Provide a variety of age or size class wildlife habitat diversity, from seedlings to mature sawtimber.
- Emphasize wildlife.
- Provide a roaded natural setting for all types of developed and dispersed recreation opportunities, with an emphasis on motorized activities.

2] Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on only 46,000 acres on low site oak Analysis Areas, low stocked Analysis Areas, and areas with large acreages of conifer stands. It calls for red pine or white pine (if the weevil problem subsides) on the medium to well-drained sites and spruce on the very poorly to poorly-drained sites. A study titled the Biologic and Economic Feasibility of Coniferous Timber Production Systems for the Allegheny National Forest (Strauss and Bowersox, 1982) determined medium and well-drained soils on these Analysis Areas provide the best opportunities for conifer production on the Forest. They yielded the highest soil expectation values. We added the poorly-drained sites since they are significant inclusions within the low stocked Analysis Areas. A second non-FORPLAN analysis report completed by the ANF timber staff (Hockinson, 1983) confirmed the results of the Strauss and Bowersox report with respect to the best sites to be planted.
- Prescription 4 is a choice on a small portion of the ANF (20,000 acres of low stocked, 16,000 acres of low site oak, and 10,000 acres of existing conifer stands or a total of 9% of the total Forest acreage). To keep analysis costs down, we restricted the number of management intensities to High, Medium, and Low for recreation/wildlife and a high intensity for timber management which includes numerous thinnings.

h. Management Prescription 4.01

This prescription emphasizes providing a forest composed of a mosaic of conifer stands with associated understories that provide habitat for game and non-game wildlife species in a setting dominated by intensive oil and gas development.

1) Purpose

- Provide a sustained yield of softwood sawtimber using even-aged management.
- Provide a variety of age or size classes for wildlife habitat diversity.
- Emphasize wildlife.
- Emphasize hunting within a roaded natural recreation setting.
- Manage high intensity oil and gas development on outstanding, reserved, and USA mineral ownerships.

2) Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on large areas of existing conifer stands, low site oak AA's, and low stocked AA's.
- Many forms of dispersed and developed recreation are not compatible with high intensity oil and gas development.
- Recreation and wildlife management will be Low Intensity.

i. Management Prescription 5

This prescription emphasizes management of Congressionally designated wilderness.

1) Purpose

- Provide a wilderness experience in a natural-appearing, unmodified environment within a semi-primitive non-motorized recreation setting.
- Preserve natural ecosystems.
- Protect the wilderness character for future generations.
- Provide a variety of wildlife species associated with old growth timber stands.

2) Criteria, Assumptions, and Economic Considerations

- This prescription applies to the Hickory Creek and Allegheny Islands Wilderness Areas.

j. Management Prescription 6.1

This prescription emphasizes a land condition where much of the vegetation progresses through to mature or over-mature hardwood forests.

1) Purpose

- Emphasize a variety of dispersed recreation activities in a semi-primitive motorized setting.
- Emphasize wildlife species which require mature or over-mature hardwood forests, such as turkey, bear, and cavity nesting birds and mammals.

2) Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on all Analysis Areas.
- High intensity oil and gas development is not compatible with Management Prescription 6.1.
- High, Medium, and Low Intensities for recreation/wildlife are all options for 6.1.

k. Management Prescription 6.2

This prescription emphasizes the production of hardwood sawtimber in a setting suitable for dispersed non-motorized recreation. The timber activities will occur in a ten-year, intensive management period which occurs every 40 years. Dispersed recreation activities will be emphasized during the remaining 30 years of the 40-year cycle.

1) Purpose

- Provide a sustained yield of Allegheny hardwood and oak sawtimber using even-aged management.
- Emphasize turkey and bear in all timber types.
- Provide a semi-primitive non-motorized setting with opportunity for a variety of dispersed non-motorized recreation experiences.

2) Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on all Analysis Areas.

- To keep analysis costs down, we restricted the number of management intensities to High, Medium, and Low recreation/wildlife and a high intensity for timber management which includes thinnings but no precommercial thinnings. (Since the first commercial thinning occurs at age 80, precommercial thinning at age 25 does not produce very high returns on the investment).
- Large amounts of intensive oil and gas development are generally not compatible with providing a semi-primitive non-motorized recreation experience in 6.2. Prescription 6.2 can best be applied to areas with a low potential for oil and gas development.

1. Management Prescription 6.3

This land condition will be dominated by large savannah-like areas, open bodies of water, and vegetation dependent upon riparian conditions intensively managed to produce high populations of associated wildlife species.

1) Purpose

- Intensively manage for wildlife species which require riparian habitat, including waterfowl, furbearers, and warmwater fish.
- Emphasize dispersed recreation activities (particularly hunting, fishing, and wildlife observation) in a semi-primitive motorized recreation setting.

2) Criteria, Assumptions, and Economic Considerations

- This prescription will apply to small, site-specific locations on the Forest which are now managed as or have the potential to be managed for upland food plots, wetlands, and open bodies of water.
- A number of public agencies may cooperate in the resource management activities here.
- High Intensity recreation/wildlife management will predominate.
- We will complete the analysis and assign acreages outside of the FORPLAN model.
- Management prescription 6.3 is not compatible with intensive oil and gas development.

m. Management Prescription 6.4

This prescription is for management of Congressionally designated national recreation area.

1) Purpose

Preserve and enhance the existing semi-primitive and developed recreation uses.

Emphasize the need to conduct mineral exploration and development activities in a manner which minimizes disturbance and any resulting adverse environmental impacts.

2) Criteria, Assumptions, and Economic Consideration

This prescription applies specifically to the former Tracy Ridge, Cornplanter, and Alleghany Front Area hereafter referred to as the "Allegheny National Recreation Area."

n. Management Prescription 6.5

In this prescription, the Forest will generally have a continuous crown canopy consisting primarily of shade tolerant vegetation and interspersed openings with associated wildlife. It provides semi-primitive non-motorized recreation opportunities and no timber harvesting for 150 years followed by a 150-year period of timber management and an emphasis on roaded natural recreation opportunities, before returning once again to the semi-primitive non-motorized phase.

1) Purpose

- Provide a continuous forested scene by emphasizing the following vegetation management cycle: no timber harvesting for 150 years, uneven-aged management for hardwoods for 150 years, etc.
- Emphasize semi-primitive non-motorized dispersed recreation opportunities for the first 150 years and roaded natural dispersed recreation for the next 150 years before returning to the semi-primitive non-motorized phase.
- Emphasize quality sawtimber production of tolerant species.

- Emphasize a variety of wildlife species associated with uneven-aged habitat, including bear, songbirds, and cavity-nesting birds and mammals.

2) Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on all Analysis Areas.
- Intensive oil and gas development is not compatible with Prescription 6.5.
- This prescription emulates the land condition and management described in the book *The Lands Nobody Wanted* (Shands & Healy, 1977).
- Over time, forest vegetation will gradually move toward a more shade tolerant species composition with lower timber values.
- In FORPLAN, we assigned the next 80 years to the "semi-primitive" phase and the last 70 years of the planning horizon to the timber harvesting phase for two reasons: (1) We wanted the opportunity to model the shift in management within the 150-year Land Management Planning horizon and (2) The average age of timber on the Forest is 70 years. Volumes and values start to change drastically at age 150.

o. Management Prescription 7

This prescription emphasizes high-density, self-contained, destination-type recreation developments within a forest environment.

1) Purpose

- Provide high-density, self-contained forest recreation developments in a roaded natural or rural setting.
- Vegetation management will ensure the long-term viability, safety, and attractiveness of the area will continue throughout the anticipated life of the development.

2) Criteria, Assumption, and Economic Considerations

- This prescription applies to site-specific locations.

- Analysis for Prescription 7 will be completed outside FORPLAN. Appropriate areas will be added to alternatives to satisfy the theme of each alternative.
- Examples of existing sites which fall into this category are Kinzua Beach, Wolf Run Marina, and Kiasutha, all along the Allegheny Reservoir.
- High intensity oil and gas development is not compatible with Prescription 7.
- Apply High Intensity recreation/wildlife management.

p. Management Prescription 8

This prescription emphasizes the management of "special areas" on the Forest.

1) Purpose

- Preserve unique ecosystems for scientific purposes.
- Establish areas where we will conduct research to improve the benefits of forests.
- Protect unique areas of national significance.

2) Criteria, Assumptions, and Economic Considerations

- This prescription applies to very site-specific locations, such as the Kane Experimental Forest, Tionesta Research Area, Tionesta Scenic Area, and Heart's Content.
- Intensive oil and gas development is not compatible with Prescription 8.
- Analysis for Prescription 8 will be completed outside FORPLAN. Each alternative will include, at a minimum, the areas listed in item (a) above.
- Apply High Intensity recreation/wildlife management to Heart's Content and the Tionesta Scenic Area and Low Intensity to the other two areas.

q. Management Prescription 9.1

This prescription emphasizes a land condition with vegetation progressing through a natural succession process to mature and over-mature hardwood and softwood

forests with few investments for resource management. Natural forces play the dominant role in site or vegetation change.

1) Purpose

- Emphasize minimal management and investment in the area.
- Protect the life, health, and safety of incidental forest users.
- Prevent significant loss of existing resources or productivity on the site or on adjoining land areas.

2) Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on all Analysis Areas.
- Vegetation will gradually develop a shade tolerant species composition with lower timber values.

r. Management Prescription 9.11

This prescription emphasizes a land condition dominated by intensive oil and gas developments and vegetation progressing through a natural succession process to mature and over-mature hardwood and softwood forests. Natural forces play a dominant role in site or vegetation change.

1) Purpose

- Emphasize minimal management and investment in the area.
- Protect the life, health, and safety of incidental forest users.
- Prevent significant loss of existing resources or productivity on the site or on adjoining land areas.
- Manage high intensity oil and gas development to meet objectives (a) thru (c) above on outstanding, reserved, and USA mineral ownerships.

2) Criteria, Assumptions, and Economic Considerations

- This prescription is a choice on all Analysis Areas.

- There are few investments for resource management aside from those necessary to manage the oil and gas development.
- Vegetation will gradually develop a shade tolerant species composition with lower timber values.

3. Prescription Summary Tables

This section includes additional detailed information and displays for the topics discussed in Sections III.D.1. and III.D.2 above. The tables display the prescription choices available on each Analysis Area, the intensity choices for each management prescription, the timber timing options for a typical analysis area, and the timing of the first commercial thinning or selection cut on each Analysis Area for those prescriptions which have these activities as options.

a. Prescription Choices for Analysis Areas

Table B-4 below displays the prescription choices for analysis areas. Section III.D.2. explains the rationale for limiting the availability of certain prescriptions. A more detailed presentation of prescriptions by analysis areas can be found in the process records.

Table B-4 DISPLAY OF GENERAL MANAGEMENT PRESCRIPTION CHOICES FOR ANALYSIS AREAS

<u>General Management Prescription #</u>	<u>Prescription in FORPLAN?</u>	<u>Summary of AA's Where the Prescription May Apply</u>
1/1.11	yes	All Analysis Areas where aspen exists
2/2.21	yes	All Analysis Areas
3/3.41	yes	All Analysis Areas
4/4.01	yes	Low site index oak and low stocked AA's
5	yes	Applies to Hickory Creek and Allegheny Islands Wilderness Areas
6.1	yes	All Analysis Areas
6.2	yes	All Analysis Areas
6.3	no	Applies only to existing and potential site-specific areas
6.4	yes	Applies to the Allegheny National Recreation Area.
6.5	yes	All Analysis Areas
7	no	Applies only to highly developed recreation areas around the Allegheny Reservoir
8	no	Applies only to existing and potential site-specific areas
9.1/9.11	yes	All Analysis Areas

Identification of Prescriptions

b. Recreation/Wildlife and Timber Intensity Choices for Each Prescription

Table B-5 below displays both the recreation/wildlife intensities and the corresponding timber intensities for each Management Prescription. It also shows the Analysis Areas where each is a valid choice. Each listed recreation/wildlife intensity is an option for each listed timber intensity. "H, M, L" means High, Medium, and Low as defined in Section III.D.1.d.3(b). For Management Prescription 3/3.41, the listed timber intensities are broad categories, which (in FORPLAN) may each consist of several sub-intensities differing by the number of thinnings or the timing of thinnings in either the existing or regenerated yield tables.

Table B-5 DISPLAY OF RECREATION/WILDLIFE AND TIMBER CHOICES FOR EACH MANAGEMENT PRESCRIPTION

<u>Prescription</u>	<u>Rec/WL Intensity</u>	<u>Timber Intensity</u>	<u>Analysis Areas</u>
1/1.11	H	commercial, non-commercial	all
2	H, M, L	one	all
2.21	L	one	all
3	H, M, L	precommercial & commercial thin	high site oak, high CAPs-high stocking
	H, M, L	commercial thinning	all except low stocking
	H, M, L	regeneration cut only	all except low stocking
	H, M, L	type conversion (oak to CAPs)	oak high site
	H, M, L	plant CAPs and commercial thin	all low stocking
3.41	L	same 5 intensities listed for 3	same as for 3
4	H, M, L	regeneration cut in existing & commercial thin in regenerated conifer stand	low stocking & low site oak
4.01	L	same as for 4	same as for 4
5	L	one	Hickory Creek Allegheny Islands

Table B-5 (con't) DISPLAY OF RECREATION/WILDLIFE AND
TIMBER CHOICES FOR EACH MANAGEMENT
PRESCRIPTION

<u>Prescription</u>	<u>Rec/WL Intensity</u>	<u>Timber Intensity</u>	<u>Analysis Areas</u>
6.1	H, M, L	one	all
6.2	H, M, L	commercial thinning	all
6.3	H	one	site specific
6.4	H, M, L	one	Allegheny National Recreation Area
6.5	H	one	all except low stocked
7	H	one	site specific
8	H	one	site specific
9.1/9.11	L	one	all

c. Analysis Area Age at First Commercial Thinning or
Selection Cut

Table B-6 below lists all of the prescriptions with timber intensities which have commercial thinnings or selection cuts. Secondly, it shows the earliest age for the first possible commercial entry. Following this first entry, each Analysis Area for prescription 3 has a commercial thinning option every 20 years thereafter. In 3, no thinnings occur after the Analysis Area is 120 years old. Selection cuts occur on a 20-year cycle for every intensity in 2, 2.21, or 6.5. The age of first entry is 60 years, with analysis areas older than 60 years requiring a series of cuts 20 years apart to bring them into an unevenaged condition. In prescriptions 2 and 2.2, each Analysis Area has the option of waiting until age 70 for the first entry. Prescription 3 also has this delayed entry option on the Analysis Areas which have the highest PNV (see Timber Financial Analysis in planning record), those with high CAPs and high stocking.

Identification of Prescriptions

Table B-6 AGE OF ANALYSIS AREA AT FIRST COMMERCIAL THINNING OR SELECTION CUT ENTRY

<u>Prescription</u>	<u>Analysis Areas</u>	<u>Age at First Possible Entry</u>
2 /2.21	all	60 years
3 /3.41	oak-all	60 years for all intensities except precommercial thinning
	-High site	50 years for precommercial thinning intensity
3/3.41	ALL CAPs	
	45-74% stocked	80 years
	75% stocked	60 years
	25% CAPs	50 years for precommercial thinning intensity
4 /4.01	Low stocked & Low site oak	35 years for spruce and 25 years for red pine
6.2	all	80 years
6.5	all	150 years

d. Display of Timber Timing Options

Timber timing options in the FORPLAN model vary according to the following characteristics: timber type, stocking level/site index, and timber intensity. Section III.D.1.d., covers additional information about the timing options. Table B-7 below shows an example of the wide range of timing options available in the model. It displays the range of choices available for timber harvesting prescriptions on all of the 60-year-old Analysis Areas. This covers a major portion of the total Forest acreage, since 45% of the area is in this age class. Prescriptions 3 and 3.41 contain roughly 80% of all the options.

For each Analysis Area, Table B-7 shows the range of timing options for both the existing stand and the regenerated stand for each timber intensity. The numbers, expressed in decades, are the range of rotation ages permitted in the FORPLAN model. Timing options result from combining each age in the existing stand with each age in the regenerated stand, excluding those options which in the regenerated stand call for final harvest beyond decade 17. In order to keep the number

of options to a reasonable level, we have also excluded every other rotation age in the regenerated stand. (We ran the Max PNV Benchmark with all timing options and again with only every other timing option in the regenerated tables. The results showed an insignificant change in PNV occurred, and timber harvest volumes did not significantly change. Reducing the timing options did, however, significantly decrease the computer costs for the run. See planning record for more detail). These specifications yield 9,681 timber intensities and 29,044 timing options when we add the H, M, L recreation and wildlife intensities. These timing options apply to all Forest Plan alternatives except those which emphasize a "big tree" effect, Alternatives A and E.

For alternatives which emphasize "big trees", we specified that no regeneration cuts could occur on any Analysis Area until that Analysis Area has reached 95% of the culmination of mean annual increment (CMAI) of dollar value per acre, as recommended by the Pittsburgh office of the Sierra Club. On the Allegheny, this point always occurs after CMAI of volume growth per acre. This increases the first entry rotation age to 100, 110, or 120 years, depending on the Analysis Area. In order to continue to provide the wide range of timing options for each intensity, we increased the upper limit of the range from 150 to 200 years on all Analysis Areas. This results in 4,593 timber timing options and expands to 13,779 when the H, M, L recreation and wildlife intensities are added. The following accounts for the significant reduction in timing options:

- In the "big tree" concept, we did not permit prescriptions which allow oak to convert to Allegheny hardwoods.
- Even though we extended the upper limit of the range to 200 years, the model does not count many of these. It drops all options which call for final harvesting in the regenerated stand beyond decade 17.

This chart shows the timing options for only the 60-year-old age class. Other age classes have slightly different CMAI's, so the age at the lower end of the range will differ by 10 to 30 years. All Analysis Areas have 150 years as the upper limit for Prescription 3, except the low stocked.

Identification of Prescriptions

Table B-7 TIMBER TIMING OPTION CHOICES FOR PRESCRIPTIONS ON 60-YEAR-OLD ANALYSIS AREAS

Pre- scrip- tion	#Timing Choices	Timber Type	Stocking/ Site Index	Intensity*									
				Regen. Cut Only		Commercial Thin		Conversion		PCT & Com- mercial Thin			
				Exist	Regen	Exist	Regen	Exist	Regen	Exist	Regen		
1/1.11	6	Aspen Inclusions	All	5-7	3-4								
2/2.21	2	All	All	Make first selection cut at 60 or 70 years.									
3/3.41	Many	Oak	SI>65 SI<65	6-15 6-15	5-15 6-15	8-15 8-15	8-15 8-15	8-15 8-15	8-15 8-15	8-15 8-15	7-15 7-15		
		High CAPs	45-74% ≥75%	8-15 6-15	6-15 5-15	9-15 8-15	9-15 7-15					8-15	7-15
		Low CAPs	45-74% ≥75%	8-15 7-15	8-15 7-15	9-15 8-15	9-15 8-15						
4/4.01	Many	All CAPs	<45% SI<65					6-20	8-15				
6.2	Many	Oak	All			8-15	7-15	10-18	12-20				
		Low CAPs	All			10-18	12-20						
		High CAPs	All			10-18	12						
6.5	1	Make the first entry when the Analysis Area is 150 years old											
TOTAL	9,681	For all ages on all of the Analysis Areas combined.											

*The numbers displayed below in each column show the range of rotation ages included in FORPLAN for each intensity and timber type combination. The first number in each column is the earliest age for regenerating an analysis area and the last number is the oldest age (ex. 6-15 means earliest age is 60 years and latest is 150 years). We established the earliest age for each analysis area by calculating when it reached 95 percent of CMAI.

e. Process Used to Ensure Availability of a Broad Range of Prescriptions

The discussion in Section III.D.1.b. and Section III.D.1.c. explains Allegheny National Forest's efforts to ensure that a broad range of prescriptions are available to 1) meet the objectives of each alternative and 2) to properly evaluate a broad spectrum of resource management opportunities.

E. Process for Developing Prescription Yield Coefficients

The process used to develop yield coefficients varies by Resource Element, Analysis Area, and Management Prescription. The effort we expended to develop a given yield table was directly proportional to the significance of the relationship to the planning problems, cost/value impacts, and the overall applicability of the Management Prescription to the Forest. Section II.A.3. provides an overview of the yield coefficient development process. The remainder of this section discusses additional details about the development of production coefficients.

1. Timber

The timber yield coefficient development process varies by timber type and Management Prescription. Our Land Management Planning process records contain specific details regarding each yield table's development.

a. Prescription 1/1.11

We reviewed the following sources of information which are described in Section II.B.

- timber inventory data in TMIS,
- growth projections from SIMAH for low CAP Analysis Areas,
- STEMS aspen growth projections for the Chippewa National Forest,
- published aspen yield tables for the Lake States from Agricultural Handbook #486.

STEMS estimates and the published aspen yield tables all reflect higher cubic volumes per acre than values from SIMAH (see SIMAH explanation) for low CAP Analysis Areas. The cubic volume yields from SIMAH looked more reasonable for our poorer quality stands which have a significant aspen component. Since Prescription 1/1.11 will not apply to any more than 10,000 to 20,000 acres in any Alternative, we used the SIMAH values as our best estimate of 1/1.11 timber yields.

b. Prescriptions 2/2.21

In recent years the Allegheny National Forest has not practiced much uneven-aged management so there is very little growth and yield data available. The Northeast Forest Experiment Station, using a local stand table for low CAP Analysis Area, used SIMAH to make growth and yield projections for uneven-aged management. We then applied this volume table to all Analysis Areas, making slight volume adjustments which we felt were necessary. We also adjusted stumpage values (by timber type) to more closely show the differences in value which currently exist for the various timber types, using the values in Prescription 3 as a guide.

c. Prescription 3/3.41

The yield tables for this prescription came from two sources: yields for low and high CAP Analysis Areas came from SIMAH, while the oak yields came from published research (Dale, 1972) tempered by our professional knowledge of local growth response and timber sale yields. For the high and low CAP Analysis Areas, we provided the Northeast Forest Experiment Station with a set of stand tables from TMIS for each appropriate Analysis Area type. Using these stand tables and SIMAH, they projected growth and yields out to age 150. We added 50 more years based on our professional knowledge so that each timber yield table extends to age 200. For oak Analysis Areas we used Dale's published unmanaged yield tables and adjusted them to reflect thinning yields and subsequent growth response based on our local professional knowledge. Yields for CAP Analysis Areas from SIMAH provided a good point for comparison.

d. Prescription 4/4.01

This prescription has two yield tables: red or white pine for medium to well-drained sites and spruce for poorly to very poorly-drained sites. For red pine we reviewed the following data sources:

- Growth and Yield of Red Pine in Minnesota
(USDA-FS, 1962)
- Growth and Development of Older Plantations in Northwestern Pennsylvania (Grisez, 1968)
- TMIS inventory data

Griez's local volume tables compared favorably with the unmanaged yield tables for Minnesota. However, we believe that the Minnesota tables better represent our expected volumes, and we used them as the basis for our unmanaged tables. We then adjusted them to reflect thinnings and subsequent growth response. For spruce we reviewed the following information:

- spruce/fir tables from the White Mountain National Forest,
- STEMS growth projections for spruce on the Chippewa National Forest.

Using these tables as a guide, we developed a table to fit the growth and yield response we have observed in the few existing spruce plantations on the Forest.

e. Prescriptions 5, 6.4, 9.1, 9.11

These prescriptions do not have any substantial amount of timber harvesting. In order to keep track of the timber volume inventory for them, we entered the unmanaged yield tables from Prescription 3 in the FORPLAN model.

f. Prescription 6.1

Following the public review period for the planning documents, we adjusted this prescription to more clearly explain and model the wildlife vegetation manipulation which will occur. In the draft we simply tracked the standing timber inventory using the unmanaged yield tables from prescription 3 for each analysis area. For the final documents we calculated average per acre yields from the FORPLAN results for Alternative D by harvest method. Then we applied these to the acres treated each decade in Management Area 6.1 and added them manually to all of the summaries in the documents.

g. Prescription 6.2

This prescription only permits timber harvest activities during one ten-year period out of every 40 years. We used the Prescription 3 yield tables as the basis for the 6.2 tables, and we adjusted them using our professional knowledge of growth and yield response so the thinnings would conform with the periods when timber harvest is permitted. We did not permit any regeneration cutting before 95 percent CMAI.

h. Prescription 6.5

Since we do not expect this prescription to apply to a significant portion of the Forest in any of the alternatives, we did not make special SIMAH runs for it to calculate yields. Using growth and yield responses developed for 3 and 2 as background data, we developed a new set of yield tables for 6.5 by hand.

i. Timber Volume Adjustments

The timber yields produced through the process described above for each Management Prescription did not include all of the adjustments necessary to account for inclusions of land which will not produce timber or which will have reduced yields for multiple-use reasons. Consequently, we have applied the following timber volume adjustment factors to the yield tables for all analysis areas in the FORPLAN model. Our Land Management Planning process records contain a detailed discussion of the procedure we followed to calculate them. Section II.A.3. and III.B.1.e. provides additional information. Some of these reductions result from activities implemented to meet minimum management requirements.

Table B-8 TIMBER YIELD REDUCTION FACTORS BY MANAGEMENT PRESCRIPTION

Reason for Reduction	Reduction Amount by Prescription							
	1	1.11	6.5 2	2.21	3 6.2	3.41	4	4.41
1. Conifer, Aspen, Roads, R/W, Perm. Openings	.15	.15	.10	.10	.10	.10	.06	.06
2. High Intensity OGM	--	.13	--	.13	--	.12	--	.13
3. Steep	--	--	.005	.005	.024	.024	.024	.024
4. Rocky	--	--	.025	.025	.025	.025	.025	.025
5. Riparian	.009	.009	--	--	.009	.009	.009	.009
6. VQO	--	--	--	--	.029	.029	.029	.029
TOTAL VOLUME REDUCTIONS	16	.29	.13	.26	.19	.31	.15	.28

2. Recreation

Recreation yields in the FORPLAN model include only those resulting from dispersed recreation use. We estimated the developed recreation yields outside the

Developing Prescription Yield Coefficients

model for each specific site using RIM historical use figures, site capacity (which relates to ROS Class and site characteristics), and professional judgment. The dispersed recreation yield coefficients vary by Management Prescription and management intensity within each prescription. The Allegheny National Forest planning records specifically describe how we developed the coefficients for each prescription and intensity. The following is a brief description of the process.

First, we identified sample land areas on the Forest which we felt represented each Recreation Opportunity Spectrum (ROS) Class. Based on an analysis of the samples, we then calculated an average maximum capacity (Persons at One Time-PAOT) for each ROS Class. The ROS User's Guide (USDA-FS, 1982) and RIM provided background information. Next, we estimated Recreation Visitor Day's (RVD's) of potential use for each of these ROS Classes using the formula in the ROS User's Guide. We used professional experience and RIM data to develop the values of the independent variables in that equation. Each Management Prescription's potential RVD yield then relates to its respective ROS Class. Using the specific recreation objectives for each prescription, historical RIM use data, and professional judgment, we estimated the actual use we felt each Management Prescription would yield. This included estimating the expected actual use for each recreation intensity within each Management Prescription. Low Intensity emulates the current level of actual use which is about 12 percent of the potential use. Medium and High produce progressively higher yields based on increased investments. Here is a sample of the type of adjustments we made to the ROS Class yields: 1) each high intensity OGM prescription with one well every 500' as well as roads and pipelines to each well produces approximately 75 percent lower yield than does its corresponding low intensity OGM development prescription, and 2) Prescription 2, with a roaded natural ROS Class but with a continuous forest canopy, produces 30 percent more RVD's than the current Forest-wide average for roaded natural. Again, this work resulted in RVD yield coefficients for each Management Prescription and for each management intensity therein.

3. Wildlife

In Land Management Planning we have considered the following kinds of Wildlife and Fish User Day's (WFUD's) yields: big-game, small-game, furbearers, waterfowl, and non-game. Wildlife yields in the FORPLAN model include only the big-game category. Big-game WFUD's are a function of the Management Prescription activities, timber age, and timber density. We calculated the rest of the yields outside of the model based on the final results of each alternative. Non-game WFUD's are a fixed percentage of the dispersed recreation use. Small-game, furbearer, and waterfowl WFUD's estimates are related to habitat improvement and timber type. Pennsylvania Game Commission data was used. To calculate big-game WFUD's, we used yield coefficients developed for timber age and type classes and the Pennsylvania Game Commission's hunter game take survey information.

The following is a brief description of the process we used to calculate the FORPLAN big-game WFUD coefficients. The Pennsylvania Game Commission has developed estimates for big-game (deer, turkey, bear) carrying capacity. These are the populations we can carry and still be able to regenerate timber without making substantial investments in regeneration practices which will limit deer browsing damage to new seedlings. We refined these using our professional judgment to show carrying capacities for three major management strategies and the management intensities therein: uneven-aged management, even-aged for conifers, and even-aged for hardwoods. This gave us yields we could apply to all of the general management prescriptions. First, we developed carrying capacities for timber age and density classes assuming only the maintenance of existing wildlife habitat improvements. These yields reflect primarily the population changes we can expect from timber harvesting and size class changes. We defined this as Low Intensity. Next, we developed carrying capacities for the same identifiers for the Medium and High Intensities for wildlife management, each having progressively more habitat development and progressively higher carrying capacities. Research conducted by the Pennsylvania Game Commission has established harvest rates for the major game species and the number of WFUD's required to harvest one animal. Multiplying the carrying capacity by the harvest rate by

the number of WFUD's required to harvest one animal gives us the total WFUD production coefficient for the identifier.

Deer populations on the Forest currently exceed the carrying capacities described above. Several years ago the Forest, in cooperation with the Pennsylvania Game Commission, began to more carefully monitor and regulate the deer harvest so we could reach these objectives. The FORPLAN model includes the carrying capacities described above not the current levels. The fern/striped maple understory problems are additional complicating factors. Assuming we achieve the carrying capacity, it was estimated that within 50 years we will only need 20 percent of the current regeneration investments.

IV. ECONOMIC EFFICIENCY ANALYSIS

A. Describe PNV

The regulations published in the Federal Register, September 30, 1982 states that the Forest Service should develop a planning process in which "..... the resulting plans provide 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 219.1)." Net public benefits is defined to be "the overall 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. The definition of "net public benefits" and the current state-of-the-art methodology in economics and all other disciplines rules out the possibility of a single value or index to represent net public benefits. Instead, the Forest planning analysis process sought to simultaneously analyze and display all outputs, inputs, and effects so decision-makers could weigh all of the values identified by markets, preferences, and trade-offs to determine the allocation of resources that comes nearest to the greatest long-run net public benefits.

Present net value (PNV) is one of the criteria used to determine net public benefits in benchmarks and alternatives for the Allegheny National Forest. PNV is the difference between the discounted value of all priced outputs and all Forest Service management and investment costs over the analysis period or 150 years. The PNV of each alternative estimates the value of the maximum attainable net benefits of priced outputs.

The priced outputs which are included in PNV are those that are or could potentially be sold in the market place. On the ANF, the priced outputs were the stumpage value of timber and recreation visitor days (RVD's) of developed recreation, dispersed recreation, hunting, fishing, and wilderness use.

Present Net Value (PNV)

The alternatives are designed and analyzed to achieve their goals and objectives in a manner that achieves the greatest excess in the value of priced outputs in relation to their cost while meeting all specified constraints and objectives for non-priced outputs. Thus, the PNV of each alternative estimates the value of priced outputs realized in excess of all the Forest Service costs of producing priced outputs, non-priced outputs, and meeting management requirements. Net public benefits therefore can be defined as the sum of PNV plus the full value of non-priced outputs. The full value can be used because its cost of production is already accounted for in PNV.

Present Net Value (PNV)

B. Parameters

1. Discount Rates

The discount rate represents the cost or time value of money in determining the present value of future costs and benefits. The Allegheny NF performed the cash flow analysis in Forest planning using a 4 percent discount rate to evaluate benchmarks and alternatives. This rate approximates the return on long-range investments above the rate of inflation.

2. Demand Curves

Reasons for estimating future resource demands fall into three categories:

- a. Maximum anticipated amounts of resource or use which is likely to be consumed needs to be estimated so that excess output amounts will be not valued in the analysis. Demand "cut-off" constraints are available to DE FORPLAN for this purpose.
- b. Price/quantity relationships for goods and services need to be determined if downward sloping demand curves are to be used in the analysis.
- c. Society's preferences for goods and services need to be known to guide the allocation of land, labor, and capital.

We wanted to estimate demand or consumption for all modeled outputs, particularly those related to the problem statements.

RECREATION/ WILDLIFE

The problem posed in the recreation/wildlife problem statement concerns the best or optimum mix or recreation opportunities to provide on the Allegheny National Forest. We believe this mix is best measured by evaluating RVD's in the ROS categories. Thus, we attempted to forecast recreation and wildlife consumption levels for each ROS class.

Consumption estimates for recreation and wildlife were derived from applying the recreation growth indices from the 1980 RPA "An Assessment of the Forest and Rangeland Situation in the United States," to the current recreation and wildlife use levels.

Present Net Value (PNV)

The following is a comparison of projected recreation and wildlife consumption to the results of the Max PNW benchmark run:

	Decades				
	1	2	3	4	5
Projected Total Demand for Disp. Recreation/ Wildlife Use (M RVD's)	13,406	15,612	19,034	21,617	25,588
Total Dispersed Use From Max PNW FORPLAN Run (M RVD's)	11,683	13,014	14,153	15,187	15,673

In every decade, RVD's from the benchmark run is lower than projected consumption. Thus, demand cut-offs set at the projected total use level, would not have been binding in FORPLAN.

Based on (1) the high occupancy rates of campgrounds along the Allegheny Reservoir and (2) results of public involvement with leaders in the recreation field, the Management Team concluded that demand exists for new campgrounds and access to major water bodies on the Forest. These water bodies include the Allegheny River and Reservoir, Clarion River, and Tionesta Creek.

WILDERNESS

No efforts were made to quantify the demand for wilderness use. The ID Team concluded that the demand for wilderness experiences on the Allegheny National Forest is very high given that half the country's population lies within a day's drive of the Forest. There are no designated Federal wilderness areas in Pennsylvania, New York, or Ohio, although New York has the Adirondack Preserve. There is a significant wilderness opportunity in Canada. The Commonwealth of Pennsylvania manages a system of relatively small wild areas.

Demand for wilderness designation on the Forest is obviously high, and the available supply in Pennsylvania is low.

GRAZING

The Allegheny National Forest has areas that could provide grazing units. However, according to a study by Bowersox and Strauss (1980) the market demand for grazing areas is near nonexistent. Bowersox and Strauss surveyed private livestock owners adjacent to the Forest.

Present Net Value (PNV)

The survey revealed that the livestock operations are relatively small and the operators have adequate supplies of pasture at, or very near, the central farm. Since public demand for hay or livestock grazing is nonexistent, no management of this resource is planned.

TIMBER

Local timber demand curves from the Allegheny National Forest were not used in FORPLAN for the following reasons. The market for the timber species sold on the Allegheny National Forest is so large it is difficult to develop a curve which accurately reflects future demand. Examination of historical data of timber offered only indicates what was done in the past and is not necessarily an indication of future needs. In fact, in the past few years, the Forest has seen a large increase in timber offered. The increase was a response by the Forest to the timber volume under contract decreasing, indicating that (1) demand is high and (2) more timber could be sold if offered. Even with the increased timber offered there have not been any "no bid" sales, again indicating demand is high.

A meeting with members of the local timber industry indicated that (1) the ANF is a relatively small part of the region's sawtimber and pulpwood market, (2) the ANF could triple its sawtimber offer without requiring any major new investments in mill capacity, and (3) the ANF could double its sawtimber offer immediately with few "no bid" sales. Examination of the "maximum timber" benchmark run indicates that in Decade 1 timber volume does not double and at no point in Decade 3 will the volume offered triple.

Based on this information, we estimate the demand curve for the Allegheny National Forest to be a horizontal line, meaning that timber demand is greater than the production capabilities of the Forest. Therefore, demand cut-offs for timber outputs were not used in the FORPLAN model.

OIL, GAS, AND MINERALS

This nation's oil and gas industry began 125 years within a few miles of the Allegheny National Forest. Ten percent of the Forest's surface area is intensively developed for oil and gas production. Extensive oil and gas deposits still underlie the area.

Almost 94 percent of the oil, gas, and mineral rights under the Forest are owned by the private sector. The private mineral owner determines the development schedule.

Present Net Value (PNV)

Continued oil and gas exploration and development may occur anywhere on the Forest, though there are some areas which have a higher probability. As the price per barrel of crude oil increases, secondary and tertiary recovery on old, shallow fields become economically practical. Exploration for new, smaller fields also becomes worthwhile. We can also expect future oil and gas production from deep reservoirs. The current limited production from deep formations probably reflects the low amount of exploration done in them rather than the absence of petroleum reserves.

One indicator of demand for oil and gas from the Forest is the number of wells shown on private developers' State drilling permit applications. The Forest began collecting this information for proposed development on Allegheny National Forest in 1976. The number of private drilling permit applications for the Allegheny National Forest for 1976 - 1982 is summarized below:

<u>Fiscal Year</u>	<u>Total Number of Wells</u>
1976	256
1977	293
1978	383
1979	410
1980	737
1981	558
1982	942

There are 52,000 acres of existing high intensity oil and gas development. We have defined a high intensity development as one with five or more wells spaced less than 1,000 feet apart. Each well affects approximately 5 acres surrounding it, and with the access roads results in about 3/4 acre of cleared land.

We have made three alternative estimates of the demand for oil and gas from the Allegheny National Forest which we have called high demand, medium demand, and low demand. These translate into three estimates of oil and gas development activity. All of them increase the level of high intensity oil and gas development on the Forest over the 150 year planning period. With the low demand projection, there will be an additional 13,000 acres, and with the high demand projection an additional 137,000 acres. We expect the actual amount of development which occurs over the next few decades to be closer to the high estimate than to the low.

Present Net Value (PNV)

For each we have estimated the number of new wells, the new acres cleared, and the new acres affected. Table B-9 displays these for the Low and the High Demand scenarios.

Table 2-8 in the Final EIS displays the BBTU's of energy produced and the total value based on the 1982 price per barrel of oil, discounted to 1978 dollars.

Table B-9 Private Oil and Gas Activity Projections for low and high demand by decade

DECADE	NEW WELLS DRILLED		NEW ACRES CLEARED		NEW ACRES AFFECTED	
	LOW DEMAND	HIGH DEMAND	LOW DEMAND	HIGH DEMAND	LOW DEMAND	HIGH DEMAND
1	860	8600	.6	6	4	43
2	860	8600	.6	6	4	43
3	602	6020	.5	5	3	30
4	344	3440	.3	3	2	17
5	172	1720	.1	1	1	9

High Demand

This level is based on the highest oil and gas development activity the Forest has experienced, which occurred between 1980 and 1982. Any of the following events would tend to make high demand a reality:

- price of oil or gas remains high or increases;
- technological improvements in oil recovery;
- deep gas exploration leads to more than one major discovery on the Forest;
- preferential tax treatments or other government incentives for oil or gas development continue or increase;
- embargoes or other disruptions of U. S. overseas energy supplies.

Medium Demand

The medium demand estimates fall mid-way between the low and the high estimates.

Low Demand

The low demand estimate is based on the level of activity which occurred on the Forest in the 1960's before the energy crisis of the mid-1970's. It is about 10 percent of the high demand. Any of the following trends or events would tend to make low demand a reality:

Present Net Value (PNV)

- price of Pennsylvania crude oil drops due to major discoveries of similar quality oil on the North American Continent or due to a technological advance which decreases demand for Pennsylvania grade crude oil;
- technological improvements in oil recovery do not enable developers to wring much more oil out of the tight oilbearing sandstones;
- Federal and State governments increase taxes on oil or gas producers, or create other disincentives;
- no embargoes or other disruption of U. S. overseas energy supplies.

It is important to keep in mind that oil and gas demand is extremely volatile, and it can demonstrate sharp increases and decreases even within one decade. This kind of variability can occur even when overall the demand is low. The numbers displayed above merely represent an average.

3. Base Year Dollars

Inflation is not included in the discount rate, benefits, and costs due to the difficulty in estimating future inflation rates and because inflation was assumed to equally affect costs and prices. To insure all values and costs are treated equally in the analysis, a common base needed to be established. All values and costs are expressed in first quarter 1978 dollars. The GNP explicit price deflator index was used to inflate or deflate value and cost data to this common base.

Present Net Value (PNV)

C. Costs

1. Overview

The total cost of a prescription is the sum of the costs of each practice required to meet the objective of the prescription. Each practice requires numerous inputs such as manpower, skills, equipment, and supplies. Variations in total costs between prescriptions reflect differences in the actual combination of practices that compose the prescription, the intensity with which we undertake each practice, the Standards and Guidelines we follow, and the effect site conditions have upon the execution of practices. The total cost for Land Management Planning includes all phases of each project as well as fixed costs and overhead (general administration and program management). All of these costs are either included in the FORPLAN prescriptions or added to each alternative outside of the FORPLAN analysis process.

2. Costs Included in FORPLAN

Since we used FORPLAN as the primary analysis tool to assure that we meet the cost-efficiency requirement of 36 CFR 219.12(f)(8), we attempted to include in FORPLAN all of the project costs needed to implement a management prescription on a given Analysis Area. The total cost of each prescription results from the projects implemented and includes all phases of the project: inventory, planning and design, implementation, and monitoring. Each prescription includes minimum or base level costs which reflect the basic cost of owning the land, providing resource protection, and meeting the minimum management requirements from the NFMA Regulations. It includes such activities as fire protection, law enforcement, pest management, and a minimum amount of road and facility maintenance. For additional discussion of minimum level management, see Section VI.F.11., Section VIII.C.2., and Table B-4. Beyond these costs, each prescription contains those costs necessary to produce the minimum outputs and land condition which will achieve its overall objectives. All costs in the model are expressed in 1978 dollars.

Table B-10 displays the practices or activities whose costs we included in the FORPLAN model. It also indicates whether the costs vary by Management Prescription or Analysis Areas in the model.

Table B-10 Costs Included in the FORPLAN Model

Element	Activity	Cost Per Acre Varies by	
		Prescription	Analysis Area
A	Recreation Planning and Inventory	no	no
	Cultural Resource Inventory	no	yes
	Trail Construction & Maintenance	no	no
	Wildlife Coordination for Recreation	no	no
	Administration of Dispersed Use	yes	no
	Recreation Special Use	no	no
B	Wilderness Planning	no	no
	Wilderness Inventory	no	no
	Facility & Site Construction	no	no
	Facility & Site Management	no	no
	Property Boundary Location	no	no
	Property Boundary Maintenance	no	no
	Trail Construction & Reconstruction	no	no
	Trail Maintenance & Operation	no	no
	Wildlife Coordination	no	no
C	Fish/Wildlife Surveys	yes	no
	Non-Structural Habitat Improvement	yes	no
	Non-Structural Habitat Maintenance	yes	no
	Structural Habitat Improvement	no	no
	Structural Habitat Maintenance	no	no
	Recreation Coordination in C Element	no	yes
	Habitat Improvement-Bulldozing	no	no
E	Timber Harvest Administration	yes	yes
	Stocking Surveys	no	no
	Animal Control	no	yes
	Site Prep for Natural Regeneration	no	yes
	Aerial Fertilization	no	no
	Unmerchantable Stem Treatment	no	yes
	Fern-Striped Maple Control	no	yes
	Fence Maintenance	no	no
	Site Prep for Planting	no	yes
	Timber Stand Improvement	no	yes
	Sale Planning and Preparation	yes	no
	Local Road Construction	yes	yes
	Local Road Reconstruction	yes	yes
Local Road Maintenance	yes	no	

Costs

Table B-10 (con't) Costs Included in the FORPLAN Model

<u>Element</u>	<u>Activity</u>	<u>Cost Per Acre Varies by</u>		
		<u>Prescription</u>	<u>Analysis Area</u>	
E	Silvicultural Exam	no	no	
	Property Boundary Location	yes	yes	
	Boundary Line Maintenance	yes	no	
	Recreation Coordination for E Element	no	no	
	Wildlife Coordination for E Element	no	no	
	S-W-A Coordination for E Element	yes	yes	
	Mineral Coordination for E Element	yes	no	
	Rights-of-Way Acquisition	no	no	
	Cultural Resource Inventory	no	yes	
	Conifer Release	no	yes	
	G	OGM Planning and Development	yes	no
OGM Administration		yes	no	
OGM Abandonment		yes	no	
Recreation Coordination for G Element		yes	yes	
Wildlife Coordination for G Element		yes	no	
Timber Coordination for G Element		yes	no	
S-W-A Coordination for G Element		yes	yes	
Road Coordination for G Element		yes	no	
J		Special Use Management	no	no
		Boundary Line Location	no	no
	Boundary Line Maintenance	no	no	
	Land Status Maintenance	no	no	
	Encroachment	no	no	
L	Transportation System Planning & Inventory	no	no	
	FA&O Facility Maintenance	no	no	
	Dam Administration & Maintenance	no	no	
P	Fire Suppression and Presuppression	no	no	
	Law Enforcement	no	no	
	Cooperative Law Enforcement	no	no	
	Search and Rescue	no	no	
	Forest Pest Management	no	no	

3. Process for Developing FORPLAN Costs

The following is a brief summary of the process we followed when developing our FORPLAN costs:

- a. List MIH codes used in the current data base for each project-type in ADVENT,
- b. Calculate the average cost in ADVENT data base for each of these MIH activities,

Costs

- c. SO and District ID Team use these ADVENT activity costs and professional experience to develop MIH activity costs for each prescription and Analysis Area,
- d. Management Team review and verify costs for MIH activities for each prescription and Analysis Area,
- e. Enter costs in FORPLAN, and
- f. Staff and specialists make a final review of costs when looking at the first benchmark runs by comparing total costs and total outputs.

4. Costs Handled Outside FORPLAN

The Planning Team was charged with the responsibility of developing a FORPLAN model small enough so we could understand and interpret it, yet large enough so it would provide meaningful analysis and results. The Team had to make numerous assumptions and decisions before developing and running the model. One of the major decisions was to determine which activities and costs we should include in the model and which we should handle outside of it. These decisions made outside FORPLAN often had the effect of limiting the range of options available in the model. However, since the planning team was also charged with keeping the cost of running the FORPLAN model to a reasonable and justifiable limit (commensurate with the value and reliability of the information used and gained), these limitations were necessary.

36 CFR 219.12(f)(8) requires that each alternative represent, to the extent practicable, the most cost efficient combination of management prescriptions that can meet the objectives established in the alternative. FORPLAN is the primary analytical tool used to assure the alternatives are cost efficient. In cases where the decisions we made outside of FORPLAN had the potential to significantly affect cost efficiency, we completed additional analysis using historical data and the combined experience of our specialists and staff groups. This helped ensure we included the most cost-efficient strategy available to achieve the desired objective.

Costs

The reasons for not including certain activities in FORPLAN fall into three broad categories: 1) the total costs for the activities are very site specific; 2) the activities have a non-linear relation to production levels; and 3) the cost or amount of the activity depends on the level of several FORPLAN outputs, and the relationship is too complex to efficiently model. We calculated some of these activities and costs before we completed our FORPLAN runs and some after. Table B-11 shows the costs we did not include in the FORPLAN model, the general reason for not including them, whether they vary by alternative or benchmark, whether we calculated them pre-FORPLAN or post-FORPLAN, and the range of costs between the alternatives for each activity. When reviewing the costs, keep in mind they are discounted to 1978 dollars.

5. Process For Developing Non-FORPLAN Costs

The activities which we handled outside of FORPLAN and their respective costs are quite significant as a proportion of the total costs of each alternative; they constitute 51 percent to 62 percent of the total cost of each. The following discussion briefly summarizes the process we followed when developing costs for each of the activities we did not include in the FORPLAN model (see Table B-11). It also mentions the data or FORPLAN results which helped us estimate the costs.

a. Program Management

This activity includes work related to one or more resource elements but not readily identifiable with individual work projects. We followed the same basic five step approach for each resource element (recreation, wilderness, wildlife, timber, minerals, and the individual support elements) treating program management as a non-linear cost which varies by resource area and the size of the program. Here are the five steps:

- Identify a key output with each element which may be used to reflect changing program size and, therefore, program management dollar needs.
- Collect existing historical data (from PAMARS, MARS, and Program of Work data) on program management dollars and units of accomplishment for each resource area.

- Develop a predictive model using either the least squares regression approach or a fixed ratio of program development dollars per unit of key output.
- Use this model to calculate program management for each element and alternative.
- Review the results with each Resource Staff and identify control points on the linear regression (output levels) over which program management costs remained constant. Where applicable, this led to a non-linear, step like predictive model.

b. General Administration

General administration is work we cannot readily identify with specific resource elements and funding at the time we plan for it, and it is work that properly benefits all activities in the unit. A national study completed by the Washington Office Policy Analysis Staff Group in 1982 entitled "Personnel Profiles for the General Administration and Timber Systems" shows we can predict GA estimates within reasonable accuracy for any given National Forest. Region 9 historically has followed the national average, as has the Allegheny National Forest. The study concludes that we should base GA allocations on economies of scale and program of work considerations.

We used the national average curve developed in the study to calculate GA for the different total program of work costs reflected in each alternative. The following assumptions are important here:

- We assume the Allegheny National Forest fits the average curve and will experience the same economies of scale as have forests with larger budgets.
- In responding to the cost efficiency requirement of 36 CFR 219.12(f)(8), we assume historical GA budgeting patterns represent a cost efficient assignment of dollars.

c. Developed Recreation

Developed recreation construction and maintenance costs are related to specific locations within each analysis area. This makes them more difficult to model in FORPLAN. The new development will occur in the river corridors where demand is highest to support the

dispersed recreation use there. The specific construction sites within the corridor are located to minimize environmental conflicts, thereby lowering construction and maintenance costs and improving cost efficiency. The costs for each new campground are based on the historical costs incurred for our most efficient campgrounds and include the most efficient construction and maintenance methods known. After we calculated the costs for each proposed campground, the Management Team selected specific ones which would meet the objectives of each alternative.

d. Special Area Management

Special Area management costs are small and relate to specific locations on the Forest. We have included the activities and costs needed to carry out current management plans for each of them, using historical costs we have incurred over the last few years as a guide. These represent the most efficient methods we have found to manage each area to meet its objectives.

e. Fisheries Management

The activities included in the fisheries management program are those which state and federal agencies have found to be most effective and cost efficient to increase habitat capability and catch rates for sport fishes. The following are the major activities included:

- Small impoundment construction -- costs we used are based on historical construction costs incurred by the Pennsylvania Game Commission and Pennsylvania Fish Commission both on and off the Allegheny National Forest;
- Structural habitat improvement -- costs we used for fish cover construction in streams and impoundments are based on historical construction costs on the Allegheny National Forest;
- Non-structural habitat improvement -- costs obtained from the U.S. Fish and Wildlife Service, the Allegheny National Forest, and U.S. Army Corps of Engineers for liming and fertilization of lakes and streams in the local area provided the basis for these costs estimates;

Costs

- Surveys -- costs for creel census, stream surveys, and impoundment surveys which are completed to check fish response to the various types of habitat improvement came from historical data obtained from the Allegheny National Forest and the U.S. Fish and Wildlife Service.

The total cost of the fisheries management program for an alternative is the sum of the individual costs for a unique mix of each of these activities designed to meet the objectives of that specific alternative.

f. Buildings and Administrative Sites

Construction and reconstruction of buildings and administrative sites, MIH activity L24, includes preconstruction work, construction engineering, and the actual construction or reconstruction of capital improvements to support fire, administrative, and other multi-functional activities. A variety of facilities must be available to support the individual resource program levels projected in the various plan alternatives. We followed these steps in developing amounts and costs for each alternative:

- Determine if the facilities now on the administrative sites are adequate for the present level of business;
- Estimate the changes in facilities needed to support the changes in the various program levels for each alternative;
- Calculate costs for the individual facilities, then sum them for each alternative.

We used the preliminary design for the new Bradford Ranger District office as the basis for estimating costs. A consultant architect and design engineer prepared the design and associated construction estimates using local Pennsylvania construction costs. The Regional Office reviewed and accepted their estimates. Using the cost per square foot from the Bradford estimates, we then estimated the costs for the rest of the proposed facilities. Warehouses received a proportionately lower cost estimate.

Costs

g. Land Acquisition

The land acquisition we included in each alternative resulted from reviewing the objectives of each alternative and then looking at the acquisition needed to help meet these objectives. The general areas where we considered acquiring land included the major river corridors where recreation use is concentrated (Clarion, Tionesta, and Allegheny Rivers) and inholdings which are needed to improve the management efficiency on existing National Forest land. We then calculated the costs for each area we sought to acquire by making rough comparisons with comparable land recently sold in the area. Aggregating the costs for the individual areas included in an alternative yields the total cost for the alternative.

h. Mineral Acquisition

The mineral rights acquisition included in each alternative corresponds with the proposed wilderness areas and developed recreation sites included therein. To calculate the costs for acquiring the mineral rights, we made a rough assessment of the oil and gas production potential for each area. Using the recently completed mineral appraisals for Hickory Creek and the Tionesta Research Area as a guide, we then estimated the mineral acquisition costs for each area. Aggregating the costs for the individual areas included in an alternative yields the total cost for the alternative.

i. Well Plugging (USA minerals)

This includes the cost for plugging old abandoned wells forest-wide which are polluting ground or surface water. We derived the cost estimate from well plugging contracted on the Allegheny National Forest over the last four years.

j. Bridge, Arterial Road, and Collector Road Construction/Reconstruction/Maintenance

Four broad activities are included in this category: road maintenance, road construction/reconstruction, bridge construction/reconstruction, and cooperative road maintenance done by the Forest Service.

We calculated road maintenance using historical information on the cost per mile and the number of miles done each year.

Cooperative road maintenance is completed by the Forest Service but paid for by oil and gas developers as well as timber purchasers to cover their use of public roads. The cost we used is the current cost for doing the actual work.

We historically reconstruct or construct one bridge per year. We have included this in all of the alternatives.

Construction and reconstruction of arterial and collector roads occurs in three resource areas - recreation, timber, and facilities elements. In the recreation element, we reviewed the changes in recreation visitor days from the FORPLAN runs for the various alternatives and found the differences are not large enough to cause significant differences in road construction/reconstruction between alternatives. In the timber element, historical records show harvest volumes are the best indicator of changes in road construction/reconstruction amounts. Road construction varies directly with harvest volumes, and the relationship is straight line. We calculated the amounts for Alternative B; between alternatives. In the timber element, historical records show harvest volumes are the best indicator of changes in road construction/reconstruction amounts. Road construction varies directly with harvest volumes, and the relationship is straight line. We calculated the amounts for Alternative B; using this as a guide, we then extrapolated to get the amounts for the other alternatives. In the facilities element, the roads support uses by a variety of resource areas, but timber harvest volume still provides the best indicator. So we followed the same process as we did for the timber element, except we used historical mileage data for the facilities element. The costs are based on 1982 construction and reconstruction costs for arterials and collectors.

Costs

6. Describe Real Cost Increases

We did not attempt to calculate whether we have experienced any real cost increases on the Allegheny National Forest. It would be difficult for us to use our data base to come up with a valid trend analysis for individual activities over an extended period of time.

Table B-11 Summary of Costs Not Included in the FORPLAN Model

Practice/Activity	Reason for Not Including It	Cost Varies Among Benchmarks/Alter.	Range of Costs For Years in Alter. (M\$)	Costs Calculated For Pre or Post FORPLAN
Program Management	Non-linear	yes	57,027-161,000	Post FORPLAN
General Administration	Non-linear	yes	105,820-167,322	Post FORPLAN
Developed Recreation [including roads]	Site Specific for Alter.	yes	136,404-210,371	Pre FORPLAN
Land Acquisition	Site Specific for Alter.	yes	1,620- 23,400	Post FORPLAN
Mineral Acquisition	Site Specific for Alter.	yes	1,168- 19,433	Post FORPLAN
Special Area Management [Mgmt. Presc. 8]	Site Specific	no	44	Post FORPLAN
Fisheries Management	No water AA's	yes	1,185- 8,373	Pre FORPLAN
Well Plugging [USA]	Site Specific for Alter.	no	600,000	Pre FORPLAN
Arterial & Collector Rd Construction Reconstruction Maintenance Maintenance [CWFS] Bridge Construction and Reconstruction	Site Specific for Alter.	yes	40,388-103,620	Post FORPLAN
Buildings & Admin. Sites	Specific for Alternative	yes	0- 800	Post FORPLAN

Costs

D. Benefits

1. Overview

The benefits we considered in our analysis can be separated into two categories: 1] priced outputs and, 2] non-priced outputs. Priced outputs can be subdivided into two areas: those outputs with values assigned in the market place or market outputs; and those outputs with values based on the consumer's willingness to pay, or non-market outputs. Non-priced outputs are those which are not assigned a value. This section discusses priced outputs.

All benefits are expressed in 1978 dollars, with no real price changes. We have calculated benefits either in the FORPLAN model analysis or by adding them later outside the model. We realize the benefit values at similar points in the production process; we value timber on the stump and recreation/wildlife user days (based on a 12-hour day) at the site where they are consumed.

2. Benefits in FORPLAN

We have attempted to calculate as many benefits as possible within the FORPLAN model. Each prescription includes benefits which directly result from the investments or activities, as well as those induced by them (such as big-game WFUD's in the timber yield composite which result from changes in age class structure created by timber harvesting). Table B-12 shows the benefits we included in FORPLAN for projects in each element, the values used, and where we obtained each value.

Table B-12 Benefits Calculated in FORPLAN

<u>Element</u>	<u>Benefit</u>	<u>MIH Code</u>	<u>Unit</u>	<u>Value - 1978 \$/unit</u>	<u>Source of Value</u>
A	Dispersed Rec				
	SPNM	W03	RVD	9.28	1982 RPA #1
	SPM	W05	RVD	7.79	1982 RPA
	RN	W07	RVD	5.40	1982 RPA
B	Wilderness Use				
	SPMN	W03	RVD	9.28	1982 RPA
C	Wildlife				
	Big-Game	W41	WFUD	22.26	1982 RPA
E	Timber				
	Hardwood Sawtimber	X09	MBF	9.00-398.00	SIMAH #4
	Hardwood Roundwood	X10	MBF	0	Market #2
	Softwood Sawtimber	X06	MBF	10-56	Regional #3
					Values
	Softwood Roundwood	X07	MBF	8-13	Regional
					Values
	Big-Game	W41	WFUD	22.26	1982 RPA

*1 - 1982 RPA - ADVENT computer definitions file [ADVENT*RUN.STD-DE/FY85RPA] referred to on pages D11-12 of - Technical Field Guide for the 1985 RPA Process, Amendment #1; June 11, 1982; values as of January 1982.

*2 - Market - pulpwood values have historically been low on the Allegheny National Forest, (approximately one dollar per MBF), and are an insignificant part of the total timber receipts. Therefore we assigned a value of zero to pulpwood.

*3 - Regional Values - Allegheny National Forest softwood values have historically been low since we sell only a small volume of softwood. In a recent study titled Biologic and Economic Feasibility of Coniferous Timber Production Systems for the Allegheny National Forest (Strauss and Bowersox, 1982), the authors found regional softwood prices and softwood prices outside of the region are higher than ANF softwood prices. These areas, however, have "stable" market conditions where supply and demand interact to maintain some uniformity of price over time. We have used a slightly modified regional value in our analysis [which is higher than our historical market prices], assuming that a stable market and higher prices will result if we significantly increase local softwood supply. The same assumption applies to both softwood sawtimber and softwood roundwood.

*4 - SIMAH - Simulation Model for Allegheny Hardwoods values are based on ANF and Hammermill stumpage values, including an increase in realization values which reflects increases in log grade and value as stands mature. ANF and Hammermill values were averaged to give a better indication of local values.

Benefits

3. Benefits Calculated Outside FORPLAN

We had two main reasons for calculating some of the benefits outside of the FORPLAN model: 1) some were site specific and 2) some we could more accurately calculate once the FORPLAN model established the prescription assignments and schedule of outputs. These are a significant portion of the total benefits produced by each alternative; they constitute 34% to 43% of each. Table B-13 shows the benefits calculated outside of FORPLAN for projects in each element, the values used, and where we obtained each value.

Table B-13 Benefits Calculated Outside of FORPLAN

<u>Element</u>	<u>Benefit</u>	<u>MIH Code</u>	<u>Unit</u>	<u>Value - 1978 \$/unit</u>	<u>Source of Value</u>
A	Developed Rec*2				
	SPMN	W03	RVD*3	9.28	1982 RPA*1
	SPM	W05	RVD	7.79	1982 RPA
	RN	W07	RVD	5.40	1982 RPA
	R	W09	RVD	3.90	1982 RPA
C	Wildlife				
	Small-game	WW8	WFUD*3	26.29	1982 RPA
	Non-game	W48	WFUD	8.90	1982 RPA
	Fisheries	WW7	WFUD	18.88	1982 RPA
E	Timber				
	Small-game	WW8	WFUD	26.29	1982 RPA

*1 - 1982 RPA - ADVENT computer definition file (ADVENT*RUN.STD-DE/FY85RPA) referred to on pages D11-12 of Technical Field Guide for the 1985 RPA Process, Amendment #1; June 11, 1982; values as of January 1982.

*2 SPMN = Semi-Primitive Non-Motorized
 SPM = Semi-Primitive Motorized
 RN = Roaded Natural
 R = Rural

*3 RVD = Recreation Visitor Days (12 hours)
 WFUD = Wildlife and Fish User Day (12 hours)

Benefits

V. SOCIAL AND ECONOMIC IMPACT ANALYSIS

A. Current Social Situation

Area of Influence

The Allegheny National Forest's primary zone of influence is the northern Pennsylvania counties of Warren, McKean, Forest, and Elk. Some local influence also extends into various adjacent counties of Pennsylvania and New York State. These influences are due primarily to commerce (particularly timber, minerals, and construction), recreation, and relationships to the Seneca Nation of Indians, Allegany State Park in New York, and Cook Forest State Park in Clarion County, Pennsylvania. Non-local influence extends to the Pittsburgh area and to the Youngstown-Cleveland vicinity in Ohio.

Population

Resident population of the four-county area has been gradually declining since 1960, showing a decrease of 88 people in 1960-1970 and 799 persons in 1970-1980. However, two counties (Elk and Forest) showed population increase from 1970-1980, while McKean and Warren counties both had slight declines. The 1980 population of the four counties was 1.2 percent of the state of Pennsylvania.

Table B-14 Population of Counties Primarily Affected by ANF Activities

COUNTY	Population						% Change 1970 -1980
	1930	1940	1950	1960	1970	1980	
Elk	33,431	34,443	34,503	37,328	37,770	38,338	+1.5
Forest	5,330	6,227	5,331	4,954	4,926	5,072	+2.96
McKean	55,167	56,673	56,673	54,517	51,915	50,635	-2.5
Warren	<u>41,453</u>	<u>42,789</u>	<u>42,698</u>	<u>45,582</u>	<u>47,682</u>	<u>47,449</u>	-0.5
	135,381	140,132	139,139	142,381	142,293	141,494	-0.6

Historically, population fluctuations have generally followed economic trends. Early area growth resulted from the timber industry in all four counties, followed later by the oil boom, particularly in McKean and secondarily in Warren and the other two counties.

Depletion of these resources helped produce occasional periods of population decline and subsequent increase, but timber generation, changes in oil and gas recovery methods, and general economic diversification helped lead to gradual overall population increase in the general area from 1900 to the 1960's. Since then, changes in birth rate, fertility, age structure, and outmigration have contributed to general population declines.

In the 1970's, planning agencies for both Warren and McKean counties projected population increases for their areas. For example, Warren County was projected to have increases of approximately 5-6000 people per decade, giving a population of over 63,500 by the year 2,000. Projections made for McKean County were for population increase to 60,000 people by the next century. To date, the projections have not been fulfilled. Unofficial expectation for Elk County is that the population will probably never exceed 50,000.

Primary population centers are Warren, Bradford, and St. Marys-Johnsonburg-Ridgway. Smaller communities of various sizes are present along with isolated homesteads and clusters.

In 1980, the four-county area in general had a higher percentage of young people below 14 and people aged 65 and over than the state percentage. In contrast, the percentages of adults 20-34 were less than the state averages. Median ages of persons in all counties except Elk were greater than the state, with Forest County showing the greatest difference in median age (35.5 in comparison to 32.1 state-wide).

Table B-15 Percentage of Population by Age Categories (1980)

	<u>Elk</u>	<u>Forest</u>	<u>McKean</u>	<u>Warren</u>	<u>State</u>
0- 4	6.9	5.4	6.8	7.1	6.3
5- 9	7.7	7.1	7.7	7.4	6.8
10-14	9.4	8.0	8.7	8.2	7.8
15-19	9.6	9.3	8.9	8.5	9.1
20-25	7.9	6.5	7.6	7.6	8.9
25-29	7.3	6.3	6.9	7.3	7.9
30-34	6.4	6.9	6.3	7.0	7.1
35-44	10.5	10.9	10.2	11.3	10.8
45-54	10.9	10.5	10.6	11.0	10.9
55-59	5.7	6.3	5.7	5.7	6.0
60-64	5.3	6.2	5.3	5.1	5.3
65-74	7.8	11.2	9.3	8.3	8.0
75+	4.6	5.4	6.1	5.3	4.9
Median Age	31.0	35.5	32.7	32.7	32.1

The 1980 minority group population of the counties was small but rather diverse. It has tended to increase in all counties since 1970. Most of this population lives in boroughs or in the townships near them. The number of minority group members is below 1.0 percent of the population in each of the four counties, in contrast to 10.2 percent state-wide.

Table B-16 1980 Minority Group Population

	<u>Elk</u>	<u>Forest</u>	<u>McKean</u>	<u>Warren</u>
American Indian	19	13	92	66
Black	13	11	96	47
Asian Indian	16	2	34	44
Chinese and Korean	25	3	46	30
Vietnamese	3	0	14	3
Pacific Islander	9	0	12	11
Japanese	7	2	8	11
Other	27	8	34	36
	119	39	336	248
Percentage of County Population	.3%	.8%	.7%	.5%

Workforce

All four counties have diverse local economies, although the proportion of the workforce varies considerably among several categories. Elk County is the most heavily industrialized.

Table B-17 Characteristics of Workforce by Percent - 1980

<u>COUNTY</u>	<u>EMPLOYMENT IN</u>				<u>UNEM- PLOYED</u>	<u>DISABILITY</u>
	<u>Serv- ices</u>	<u>Retail/ Wholesale</u>	<u>Manufac- turing</u>	<u>Other</u>		
Elk	8.6	13.0	55.0	9.0	6.7	7.7
Forest	13.1	18.3	28.3	20.5	9.1	10.7
McKean	10.5	17.3	39.1	17.1	7.1	8.9
Warren	10.4	22.9	35.1	17.0	5.8	8.8

Income

Income levels vary considerably among the townships and boroughs in the four-county areas.

Table B-18 Resident Population Income - 1980

<u>COUNTY</u>	<u>PER CAPITA MEAN INCOME</u>	<u>FAMILY</u>	
		<u>MEDIAN INCOME</u>	<u>MEDIAN FAMILY INCOME - RANGE AMONG MUNICIPALITIES</u>
Elk	\$6,422	\$19,404	\$11,806 - \$22,312
Forest	5,691	15,492	10,938 - 17,813
McKean	6,133	17,580	15,242 - 20,738
Warren	6,563	19,160	14,107 - 22,676

Affected Groups

There are a number of categories of people who are affected by Forest management activities.

1. Local People

Timber operators are affected economically by management of the Allegheny National Forest. They encompass various combinations of ownership types and sizes.

They include small independents and large companies; new "first-generation" companies and multi-generational family operations; and individually owned businesses, father-son(s) enterprises, and larger family-owned companies. There is also a relationship between operators who buy timber contracts and independent contractors who only cut, haul, and/or process timber for them, but do not buy contracts. Of those involved in timber from the ANF, the majority come from Pennsylvania, particularly the four-county area, but several are based in New York. There are few, if any, who depend solely on ANF timber; most cut on private and state lands, as well, which reduces the impact of ANF timber volume goals.

Oil and gas operators include several categories, such as larger companies which have existed for a number of years; independents of various sizes, contractors, field workers, and others who do drilling, construction, timber cutting, tend wells, etc. The latter can be new, but many are long-term residents and businesses. There is also a concentration of OGM suppliers near Bradford. The operators, contractors, and suppliers are generally not totally dependent on operations within the national forest; many of these also work in other nearby areas of New York and Pennsylvania.

There is a strong local and regional tradition and acceptance of the lumber and OGM industries and employment within them. When possible, training, experience, and livelihood are often family occupations. However, trends in economic conditions and other factors may break this down and direct young people into other jobs and areas.

Construction contractors are an important economic group, particularly in support of timber, oil and gas operations, recreation construction, and other public and private endeavors.

Recreation is a major activity throughout the four-county area. Local people are involved as participants, particularly in hunting, fishing, and camping at developed sites, but also as suppliers of recreational opportunities through campground management, small businesses (e.g., stores and shops), marina operations, etc.

Current Social Situation

This activity is concentrated in the Allegheny Reservoir and river area, Clarion River, Cook Forest, Tionesta, and various parts of Elk County. It also occurs throughout the region on a more dispersed basis.

Due to ownership patterns, there are land and home owners who live in the Allegheny National Forest but do not necessarily work on it. They include both permanent and seasonal residents, who are affected by Forest management decisions.

Values of the counties' local population generally emphasize stability, family ties, limited mobility, desire for local control, multiple use of resources, liking for the rural/forested environment, pragmatic environmental consciousness, and reserve toward outsiders. Potential conflict may occur between year-round residents and seasonal users; between some local residents and those who want either extreme exploitation of resources or setting aside of areas; and between long-term residents and newcomers.

The Allegheny Reservation of the Seneca Nation of Indians is present just over the state boundary in New York. As of August 1982, the resident Native American population was 927 on the Allegheny Reservation and 2,154 on the Cattaraugus. There are also non-reservation Native Americans present in the four counties, as indicated in Table B-16. The Seneca, in general, have a concern for and attachment to a number of areas in and near the Allegheny Reservoir, as well as for other portions of the four-county regions.

2. Regional and National People

Recreation, timber, and minerals resources are the forest outputs most used by regional people. People from Cleveland-Youngstown-Warren, Ohio, and Pittsburgh and Erie, Pennsylvania, tend to be the heaviest regional recreation users (camping, hiking, boating, hunting, fishing, snowmobiling, and trail hiking).

Regional people also may be owners or users of seasonal homes and camps. There are over 8,000 seasonal structures in the four-county area (on all land ownership types); many are owned by non-local residents.

Some regional people are interested in parts of the forest as potential wilderness. There are also special designated areas, such as the North Country Trail, Tionesta Scenic and Natural Areas, and Heart's Content National Natural Landmarks that are of interest to this group. State parks, game lands, and other areas of interest outside the forest also attract regional people.

There is also regional interest in timber and minerals, primarily oil, gas, and (outside of the ANF) coal.

B. Effects on the Local Economy

1. IMPLAN Model

The IMPLAN model was used to estimate local economic effects. IMPLAN was developed by the Forest Service as an input-output model using base data from the 1972 National Input-Output Model, updated in 1977, and disaggregated and rebalanced at the state and county levels. We did not change the existing data base.

The estimated amount of Forest Service expenditures were taken directly from the alternatives and local impacts were estimated using coefficients from the IMPLAN base data. All the values were then deflated to the 1977 base year. The data used in IMPLAN is summarized in planning records. Complete documentation of the model is available in the planning records.

2. Profile of Four-County Area-1977

Following are IMPLAN tables which provide an economic profile of the four-county area.

Table B-19 Current Situation of Employment by Sector
That may be Directly Affected by ANF Decisions¹

<u>Sector</u>	<u>Emp. Comp. (\$MM)</u>	<u>Total Gross Output (\$MM)</u>	<u>Employment (1,000's of jobs)</u>
11 Forestry and Fishery Products ²	0.57	3.02	0.05
12 Ag, Forestry, Fishery Services ²	0.62	1.81	0.10
136 Logging Camps/Logging Contractor	1.02	8.26	0.13
137 Sawmills/Planning Mills, General	4.32	18.68	0.40
138 Hardwood Dimension/Flooring Mill	0.66	2.85	0.11
140 Millwork	1.12	5.41	0.12
144 Prefabricated wood buildings	0.11	0.66	0.01
146 Wood Pallets/Skids	0.42	2.00	0.04
148 Wood Products, N.E.C.	0.95	4.20	0.17
149 Wood Containers	0.29	1.06	0.04
150 Wood Household Furniture	0.34	0.99	0.03
159 Wood Partitions and Fixtures	0.98	2.71	0.09
164 Paper Mills except building paper	10.76	48.32	0.55
175 Paperboard Containers/Boxes	5.09	18.93	0.33
433 Retail Sales	42.35	94.55	5.85
441 Hotels/Lodging Places	1.43	3.92	0.44
447 Eating/Drinking Places	6.08	18.76	1.05
450 Amusement/Recreation Services	0.97	3.08	0.25

Effects of Local Economy

Table B-20 Employment by Aggregated Sector

<u>Aggregated Sectors</u>	<u>Employee Compensation</u>	<u>Employment thousands of jobs</u>	<u>% employment of 4-county total</u>
Forest Products	27.25	2.17	4
Recreation	8.48	1.74	4
Retail	42.35	5.85	12

- Discussion

2,170 jobs were provided in the forest products aggregate sector. 1,740 were provided by the recreation/tourism aggregate sector. Each of these aggregate sectors comprise roughly 4% of the jobs in the four-county area.

Table B-21 Exports from Four-County Area³

<u>Forest Product-Related Sector</u>	
Sawmills and Planing Mills, general	1.37
Logging Camps and Logging Contractors	.67
Hardwood Dimensions/Flooring Mill	.04
Prefabricated Wood Buildings	.03
Wood Pallets/Skids	.01
Wood Products, N.E.C.	.15
Wood Containers	.01
Wood Household Furniture	.01
Wood Partitions/Fixtures	.02
Paper Mills, except Building Paper	2.51
<u>Paperboard containers/boxes</u>	<u>.19</u>
TOTAL Forest Products-Related Exports	\$5.01 M

TOTAL Exports from 4-County Area - \$129.1 M

Percentage from Forest Products-Related Sectors - 3.8%

- 1 Data directly from 1977 Department Commerce tapes. No data manipulation.
- 2 Not all forestry related.
- 3 Not all raw material originates from within the 4-county area.

3. Effects of Alternatives

In each alternative, the ANF contributes roughly 5% to the area's employment.

Table B-22 Number of Jobs Attributable to ANF Management for Each Plan Alternative

<u>Sector</u>	<u>Alternative</u>				
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>
Forest Products	272	433	751	485	525
Recreation/Tourism	832	696	734	805	867
<u>TOTAL All Sectors</u>	<u>2,399</u>	<u>2,356</u>	<u>2,955</u>	<u>2,654</u>	<u>2,897</u>

Because of the timber outputs and emphasis on the more developed forms of recreation, Alternative C will likely account for the most jobs in the 4-county area. The employment will be nearly equal between the forest products and recreation/tourism sectors. Significant increases over the current situation can be expected.

Alternative E will provide nearly as many total jobs as Alternative C, but the ratio between sectors changes. Alternative E offers fewer jobs than C in the forest products sector, but significantly more in the recreation/tourism sector.

Alternative D ranks third highest in total jobs attributable to the ANF. The alternative offers more jobs than Alternative C in the recreation/tourism sector, but significantly fewer jobs in the forest products sector. Forest products sector jobs are still higher than the current situation, Alternative B.

Alternative A ranks fourth in total jobs, but second highest in the recreation/tourism sector. The alternative ranks lowest in job production in the forest products sector because of the low timber harvests.

Alternative B, the Current Situation, offers the fewest number of jobs attributable to the Allegheny National Forest. It offers the fewest in the recreation/tourism sector, but significantly more than Alternative A in the forest products sector.

Table B-23 portrays the employment, by economic sector, for the 4-county area in 1977 and the employment attributable to each forest plan alternative.

- Column 1. Employment By Sector

This column shows the number of jobs that each sector provided in 1977.

- Column 2. Aggregate Sector Total

This column displays the total number of jobs provided in each of the two sectors displayed - forest products and recreation/tourism. The total number of jobs in the 4-county area is also shown.

- Columns 3, 5, 7, 9, and 11.

These columns display the number of jobs, by sector, which can be attributed to management of the Allegheny National Forest. The total number of jobs attributable to the ANF is also shown.

- Columns 4, 6, 8, 10, and 12.

These columns display the number of jobs by the two aggregate sectors.

Table B-23 Employment Summaries

:1977 Four County :											
:Employment Totals: Employment Caused by ANF Actions											
	: Col. 1 :	: Col. 2 :	: Col. 3 :	: Col. 4 :	: Col. 5 :	: Col. 6 :	: Col. 7 :	: Col. 8 :	: Col. 9 :	: Col. 10 :	: Col. 11: Col. 12
	: :Agg. :	: :Agg. :	: :Agg. :	: :Agg. :	: :Agg. :	: :Agg. :	: :Agg. :	: :Agg. :	: :Agg. :	: :Agg. :	: :Agg. :
	:Emp. by :Sector :	:Sector :	:Sector :	:Sector :	:Sector :	:Sector :	:Sector :	:Sector :	:Sector :	:Sector :	:Sector :
SECTOR	:Sector :Total :	:Alt. A :Total :	:Alt. B :Total :	:Alt. C :Total :	:Alt. D :Total :	:Alt. E :Total :					
	:(# Jobs):# Jobs	:(# Jobs):# Jobs	:(# Jobs):# Jobs	:(# Jobs):# Jobs	:(# Jobs):# Jobs	:(# Jobs):# Jobs	:(# Jobs):# Jobs	:(# Jobs):# Jobs	:(# Jobs):# Jobs	:(# Jobs):# Jobs	:(# Jobs):# Jobs
FOREST PRODUCTS											
Forestry/Fishery Products:	500 :	14.4 :	22.8 :	39.8 :	25.9 :	27.3 :					
Agriculture/Forestry	100 :	6.8 :	7.3 :	9.9 :	8.3 :	8.9 :					
Logging Contractors	130 :	52.1 :	85.2 :	150.8 :	96.9 :	101.7 :					
Sawmills/Planing Mills	400 :	99.4 :	181.3 :	357.7 :	237.0 :	177.2 :					
Secondary Wood Products	110 :	3.7 :	4.0 :	5.4 :	4.3 :	5.1 :					
Paper Manufacturing	550 :	96.0 :	131.9 :	187.1 :	112.8 :	204.9 :					
TOTAL-Forest Products	:2,170 ¹		272	433	751	485				525	
RECREATION/TOURISM											
Hotels/Lodging	440 :	244.0 :	202.3 :	208.3 :	230.4 :	252.4 :					
Eating/Drinking	1050 :	356.9 :	310.8 :	341.7 :	352.1 :	391.4 :					
Amusement/Rec. Services	250 :	231.1 :	183.4 :	183.9 :	222.9 :	223.3 :					
TOTAL-Recreation/Tourism	: 1740		832	696	734	805				867	
TOTAL attributable to ANF:	unknown:	2399	2356	2955	2654	2897					
in all sectors											
TOTAL # Jobs in 4-County	48390 :										
Area (all sectors)											

¹ This column will not total 2,170 jobs because the 1977 data contains a few other categories.

Economic impacts result from (1) Forest outputs being sold, (2) users of the Forest purchasing goods and services locally, and (3) the Forest Service purchasing goods and services from the local economy in order to perform management activities.

IMPLAN breaks the impacts into three categories:

- Direct impacts are the amount of income and number of jobs generated from the production and marketing of outputs and uses on the Forest.
- Indirect impacts result from the activities of supporting industries, i.e., those industries that produce and sell their products to the directly impacted industries.
- Induced impacts come from the income expenditures of employees and owners, of the direct or indirectly impacted industries, in the local economies. All three impact components are included in the response coefficients, thus, total impact can be displayed and analyzed.

The procedure for converting changes in Forest outputs into local economic impacts consists of the following steps:

- Identify the change in physical outputs.
- Determine the direct impact (dollars per unit of output).
- Distribute the impact to the appropriate industries.
- Adjust the values to constant dollars.

The physical outputs used in the IMPLAN model are timber volumes and wildlife/fish/recreation user days.

The amount of each output produced is taken from the Forest alternatives. The values for timber products were developed using data from market reports and local mills. The values for expenditures of recreation visitors were developed using data from:

- 1980 National Survey of Fishing, Hunting, and Wildlife Associated Recreation. U.S. Fish and Wildlife Service and U.S. Bureau of Census.
- 1980 Wisconsin Camper Survey - Recreation Resources Center, University of Wisconsin - Extension.

- Winter Recreation Visitor Study - Wisconsin 1979, Upper Great Lakes Regional Commission.
- Estimated Regional Duration Activity Occasions on National Forest Lands and Waters. USDA-Forest Service, 1984.

Values given in research publications were adjusted to portray the local economy of the Forest.

VI. ANALYSIS PRIOR TO DEVELOPMENT OF ALTERNATIVES

A. Introduction

The set of alternatives for the Allegheny National Forest are the product of a lengthy and complex analysis that sought to identify the major conflicts between planning problems, determine the potential capability to respond to these conflicts or problems, and identify the quantitative and qualitative trade-offs of responding to each problem.

As is explained and documented in Appendix A, the Allegheny National Forest identified four major planning problems based on the issues, concerns, and opportunities that were identified. The Forest also initially identified potential trade-offs based on the conflicting values implied within each planning problem. To assist in measuring the potential trade-offs within the problems, evaluation criteria were also developed early in the Forest planning process to guide the formulation of the FORPLAN model. Once the FORPLAN model was built and calibrated, the Forest performed an analysis with the model and developed a set of benchmarks, which were intended to determine the potential response to the problems and to facilitate measuring the economic trade-offs among alternatives. The Forest developed a total of eleven benchmarks. The purpose, objectives, assumptions, and results of these FORPLAN analyses are discussed in detail in this Section along with Section VIII. Based on the results of benchmarks and the competitive and complementary relationships that were identified in the analysis, alternatives were established which specified goals and objectives to be achieved in response to the forest planning problems.

B. Development of Minimum Management Requirements (MMR's)

1. Overview

Federal Regulations in 36 CFR 219.27 require the Forest to meet specific MMR's when implementing forest plans. These represent the minimum legal requirements, not necessarily the lowest level acceptable to the local public or to the agency. Most forest plan alternatives provide for resource conditions significantly enhanced beyond the legal minimums.

The MMR's cover a wide spectrum of resource concerns: resource protection, vegetative manipulation, silvi-cultural practices, even-aged management, riparian areas, soil and water, and plant and animal species diversity. The Forest ID Team consulted extensively with Resource Staff Specialists, the District personnel local and national research publications, historical management experiences here, and each member's own professional knowledge when developing the responses to the MMR's. The Team members worked closely in formal and informal meetings to determine the best response to each requirement and to ensure that duplication did not occur.

Least cost analysis also played an important role in establishing the MMR's. While resource cost/yield responses are generally not accurate enough to justify detailed cost analysis of alternative methods of meeting MMR's, we have made every effort to include what we feel are the least cost methods. Much of this is based on professional experience. Where possible we included choices in the FORPLAN model to meet MMR's. The timber intensities are an example (36 CFR 219.27(c)(4)). Even where we have not included alternative choices for a specific activity within a given prescription and Analysis Area, the model does have the opportunity to pick the same prescription on a different AA where the response to the MMR is a little different due to that AA's characteristics. This provides FORPLAN the opportunity to pick the MMR response-AA combination which is most efficient. For example, MMR's require the Forest to regenerate an AA within five years of the final harvest cut. Each timber type for Prescription 3 has a different set of activities which we found to be most efficient and effective in meeting this objective.

Prescription 2 on that same AA has a different set of activities which ensure the stand structure retains the sapling size class. The FORPLAN model can then compare the cost-efficiency of 2 and 3 on any given AA or can compare efficiencies between AA's and pick the one which most effeciently produces the required yield. It can also choose a prescription calling for no timber harvesting. The FORPLAN solution, in this sense, can select the most cost-efficient method of meeting the MMR's and supplying harvest volumes.

As a result of reviewing the MMR's, the ID Team decided to use at least one of the following options, or a combination of these options, to meet the individual MMR's.

- Standards and Guidelines
- Constraints
- Project development
- Monitoring
- Analysis of spatial feasibility of prescriptions for an alternative
- FORPLAN analysis
- Analysis Outside of FORPLAN

The following discussion elaborates on each method used.

a. Standards and Guidelines

Management activities combine to produce integrated multiple-use prescriptions. Standards and Guidelines for each prescription assure we will meet appropriate MMR's. Activity costs within the FORPLAN prescriptions reflect the manpower, equipment, and other input needed to meet the requirements. The cost of achieving the MMR's reflects the influence of different site characteristics (Analysis Areas).

The following is a summary of the criteria we employed to deal with MMR's in Prescriptions as standards and guidelines:

- Base response to meet MMR's on the most cost-effective method of meeting the objective.

- Provide some choice in the FORPLAN model related to MMR's. For example, activities required to meet MMR's vary by analysis area, though there is not much variation within a given prescription on a specific analysis area. Activities also vary by prescription (2 has different activities to meet MMR's than does 3). FORPLAN then picks the most efficient prescriptions (and MMR's) for each alternative.
- The specific timber management activities included in the prescription to meet MMR's are based on research conducted on the Forest as well as historical experience. These activities vary by timber type.
- Meet MMR's through coordination activities for projects.

Example - The discussion in Section VI.B.1. adequately displays this type of MMR response.

b. Constraints

We found FORPLAN constraints to be most effective in meeting MMR's that required specific activity timing or specific allocations. The process we followed when developing the MMR's (see Section VI.B.1. above) ensured these constraints did not overlap with any MMR's met through any other method.

Example - We generally are not able to final harvest oak and regenerate it to the oak type; other hardwood species take over. We assume research will develop the technology to regenerate oak to oak within the first decade. Regulation 36 CFR 219.27(c)(3) requires adequate restocking to meet the species composition objective for the prescription. Therefore, we have applied a constraint in the first decade which does not allow any oak to oak final harvest.

c. Project Development and Planning

In some cases, compliance with MMR's depends on specific site conditions and information. Although we have developed some general Standards and Guidelines to ensure we meet these requirements, we will address the specific MMR response in more detail in project planning.

Example - Section 219.27(a)(3) of the Regulations requires protection by "utilizing principles of integrated pest management". Standards and Guidelines generally address this requirement, but since the precise application of integrated pest management principles depends on site specific information, we will address it in more detail in project plans.

d. FORPLAN Analysis and Solutions

The allocation and schedule from FORPLAN solutions will assure we meet certain MMR's. These include those requirements which depend on the set of Prescriptions included in the FORPLAN solution.

Example - Section 219.27(c)(1) of the Regulations requires "no timber harvesting shall occur on lands classified as not suited for timber production". In part, lands are not suited if they are not cost-efficient in meeting the Forest objectives over the planning horizon. The FORPLAN solution will not choose timber harvesting prescriptions on these lands.

e. Spatial Feasibility of Prescriptions for an Alternative

We also achieve MMR's through the spatial arrangement of prescriptions and through assigning specific Management Prescriptions to Management Areas. This follows the alternative development and modeling phases of the planning process. We took the FORPLAN solutions for each alternative and mapped them using District personnel to ensure no spatial problems existed which would restrict implementation.

Example - Section 219.27(d)(2) of the Regulations requires cut openings not to exceed 40 acres. We mapped the regeneration cuts called for in one of our early benchmark runs on sample areas scattered across the Forest. By carefully locating and adjusting the cut locations, we were able to implement the prescriptions with only minor adjustments to the allocation. Using this same process, we will ensure the preferred alternative does not violate the 40-acre limit. If we turn up any significant violation, we will impose specific FORPLAN constraints to correct the problem and map the new solution.

f. Monitoring

Systematic and frequent monitoring of the Forest Plan will determine whether we are achieving the MMR's specified in the categories listed above. Some requirements, however, can only be met through monitoring. We cannot set Standards and Guidelines, use constraints, or develop other methods to assure we achieve them.

Example - Section 219.27(c)(5) of the Regulations states "Harvest levels based on intensified management practices shall be decreased no later than the end of each planning period if such practices cannot be completed substantially as planned." Obviously we cannot meet this requirement without careful monitoring of planned and actual intensive management practices.

g. Analysis Outside of FORPLAN

Analysis completed outside of FORPLAN insures we will meet some of the MMR's, particularly those which require us to consider non-priced benefits or social values when selecting prescriptions.

2. Display of Allegheny National Forest Minimum Management Requirement Responses

Table B-24 displays a key word summary of each of the minimum management requirements specified in 36 CFR 219.27 along with a brief statement which describes how we assured Forest compliance with it. Those handled through Standards and Guidelines list the FSM number reference, while those which were met using constraints contain reference to the specific constraint. The forest planning records contain a more detailed description of our response to the MMR's.

Table B-24 Minimum Management Requirements

<u>CFR Reference</u>	<u>Key Word Summary</u>	<u>Method of Addressing MMR's</u>	<u>Brief Statement of Compliance</u>
219.27 (a)	<u>Resource Protection</u>		
(1)	Conserve soil and water	a c,d c,d	- Standards and Guidelines (2500) - Coordination Activity costs - Timber yield adjustment factor (see steep and riparian adjustments) in Section III.E.1.h.)
(2)	Minimize hardards from flood, fire, and erosion	a c,d c,d	- Standards and Guidelines (2500) - Coordination Activity costs - Timber yield adjustment factor (see steep and riparian adjustments, Section III.E.1.h.)
(3)	Control pests	c,d	- Fire Suppression and Presup- - Pest management costs - Standards and Guidelines (3400)
(4)	Protect streams, stream-banks, lakes, and wet-lands	a c,d c,d	- Standards and Guidelines (2500) - Coordination Activity costs - Timber yield adjustment factor (see steep and riparian adjustments, Section III.E.1.h.)
(5)	Provide for and maintain diversity	c,d a	- Dam management costs - Standards and Guidelines (1900 and 2600)
(6)	Maintain viable fish and wildlife populations	a	- Standards and Guidelines (2600)
(7)	Assess prescriptions for potential impacts	c,d c,d	- Coordination Activity costs - Cost built into other activities
(8)	Protect critical habitat for threatened and endan-gered species	c,d a	- Coordination Activity costs - Standards and Guidelines (2600)

*Legend

- a - Standards and Guidelines
- b - Constraints
- c - Project Development and Planning
- d - FORPLAN Analysis and Solutions
- e - Monitoring
- g - Analysis Outside of FORPLAN

Table B-24 (con't) Minimum Management Requirements

<u>CFR Reference</u>	<u>Key Word Summary</u>	<u>Method of Addressing MMR's</u>	<u>Brief Statement of Compliance</u>
219.27 (a)	<u>Resource Protection (con't)</u>		
(9)	Designate ROW corridors	a	- Standards and Guidelines (2700)
(10)	Road design appropriate for planned uses	c,d c,d	- Part of road design costs - Transportation planning costs
(11)	Reestablish vegetative cover within ten years of road construction	a a	- Standards and Guidelines (7700) - Standards and Guidelines (7700 and 2500)
(12)	Maintain air quality	c,d d a c,d	- Coordination Activity costs - Costs included in timber values - Standards and Guidelines (2100) - Coordination Activity costs
219.27(b)	<u>Vegetative Manipulation</u>		
(1)	Prescription best suited to multiple-use goals	d c,d d d	- Prescription development - Coordination Activity costs - Cost built into other activities - FORPLAN Analysis
(2)	Assure land adequately restocked	a c,d b	- Standards and Guidelines (2400) - Timber regeneration costs - Structural Constraints (Section VIII.B.)
(3)	Prescriptions not chosen primarily due to dollar return or greatest timber output	d d d g d,g	- Recreation values included - Wildlife values included - Numerous timing options - Social values considered - FORPLAN/Non-FORPLAN Analysis
(4)	Consider effects on residual trees and adjacent stands	a d c,d e	- Standards and Guidelines (1900, 2400, and 2600) - Timber yield tables - Timber Activity costs - Spatial feasibility
(5)	Avoid permanent impairment of site and conserve soil and water	a c,d d	- Standards and Guidelines (2500) - Coordination Activity costs - Timber yield adjustment factor
(6)	Prescriptions have desired effect on non-timber resources	a,c	- Standards and Guidelines (1900, 2200, 2300, 2400, 2600, and 2800)
(7)	Be practical in terms of transportions, harvest requirements, and costs	a,c	- Standards and Guidelines (2400 and 7700)

Minimum Management Requirements

Table B-24 (con't) Minimum Management Requirements

<u>CFR Reference</u>	<u>Key Word Summary</u>	<u>Method of Addressing MMR's</u>	<u>Brief Statement of Compliance</u>
219.27(c)	<u>Silvicultural Practices</u>		
(1)	No harvest on non-suited land except salvage or to meet non-timber objectives	b d	- Common constraints for special areas (Section VII.B.) - Timber yield adjustment factor (see rocky adjustments, Section III.E.1.h.)
(2)	Timber sale schedule gives allowable sale quantity for each period	a,c f	- Standards and Guidelines (2400) - Monitoring
(3)	Cut only if restocking assured in five years	a,c b	- Timber activities and costs - Structural constraints (Section VII.B.)
(4)	Cultural treatments for multiple-use or to promote crop tree growth	a c,d	- Standards and Guidelines 2400 and 2600 - Prescription intensities for timber
(5)	Decrease harvest levels if intensified management practices cannot be completed.	d f	- FORPLAN Analysis - Monitoring
(6)	Even-aged cutting protect other resource values	d c,d	- Timber yield adjustment factor (see VQO and riparian adjustment, Section III.E.1.h) - Coordination activity costs
(7)	Use timber harvest to prevent pest damage	a,c	- Standards and Guidelines (3400)
219.27(d)	<u>Even-aged Management</u>		
(1)	Locate openings to achieve desired multiple-use objectives	a d c,d	- Standards and Guidelines (2400, 2500, 2300, and 2600) - Timber yield adjustment factor (see opening adjustment, Section III.E.1.h.) - Coordination Activity costs
(2)	Clearcut size limits	e a,c e	- Spatial feasibility - Standards and Guidelines (2400) - Spatial feasibility

Minimum Management Requirements

Table B-24 (con't): Minimum Management Requirements

<u>CFR Reference</u>	<u>Key Word Summary</u>	<u>Method of Addressing MMR's</u>	<u>Brief Statement of Compliance</u>
219.27(e)	<u>Riparian Areas</u>	a d c,d	- Standards and Guidelines (2500) - Timber yield adjustment factor (see riparian adjustment, Section III.E.1.h.) - Coordination activity costs
219.27(f)	<u>Soil and Water</u>	a d c,d	- Standards and Guidelines (2500) - Timber yield adjustment factor, See riparian adjustment, Section III.E.1.h.) - Coordination activity costs
219.27(g)	<u>Diversity</u>	a,c d	- Standards and Guidelines - Prescription choices in FORPLAN

C. Displayed Benchmarks

1. Purpose of the Benchmark Analysis

The purpose of the benchmarks is to define the Forest's potential capability to respond to the planning problems, to define the maximum economic and biological resource production opportunities, to determine the compatibilities and conflicts between market and non-market objectives, and to define the range within which integrated alternatives will be developed. Consequently, benchmarks on the Allegheny National Forest were developed to explore the maximum response to individual values, benefits, or outputs associated with the planning problems, identify the biological production limits for significant resources, and determine the most cost-efficient level of production on the Forest. An evaluation of these benchmarks allowed the Forest to identify the competitive and complementary relationships that existed between planning problems, outputs, and allocations. It was then possible to use the benchmark analysis to formulate alternatives which recognized the competitive and complementary factors that existed.

Benchmarks 1 through 11 are a combination of FORPLAN and Non-FORPLAN information. Benchmarks 12 through 15 address the maximum potential of RVD's by ROS class as required in the regulation 36 CFR 219.12(a)(1)(ii). These benchmarks were done outside FORPLAN but based on coefficients used in the model. Benchmark 16 is the current management requirement in the regulation (36 CFR 219.12(a)(1)(iii)(D)(2)). Benchmark 17 is the minimum Wilderness benchmark.

2. Common and Structural Constraints

The ID Team identified legal requirements, policy direction, minimum management requirements, and technical requirements which each benchmark and alternative had to meet in order to be feasible to implement. Each FORPLAN Benchmark includes these constraints. Section VII.B. contains additional detail on the rationale behind using these constraints. Table B-25, which follows, displays the common and structural constraints we used in the benchmarks as well as our specific rationale for using each of them.

Table B-25 Common and Structural Constraints for all Benchmarks

: CONSTRAINT	: CONSTRAINT : : KTND	: CONSTRAINT : : AMOUNT	: APPLICABLE : : TIME PERIOD	: RATIONALE
: Common Constraints	:	:	:	:
: Non-declining yield	: Minimum	: Greater than: : or equal to : : previous : decade	: 1-15	: The planned sale for any future decade shall be : equal to or greater than the planned sale for the : preceding decade. This ensures a non-declining : supply of timber volume throughout the planning : horizon as required in the National Forest Manage- : ment Act (NFMA) regulations 36 CFR 219.16(a)(1).
: Long-term sustained yield	: Maximum	: Less than or: : equal to : LTSY	: 15	: The planned sale is not greater than LTSY. This : ensures the planned sale can be maintained. NFMA : regulation 36 CFR 219.16(a)(1).
: Perpetual timber harvest	: Minimum	: Greater than: : or equal to : : LTSY	: 15	: Forest inventory at the end of the planning horizon: : should be great enough to sustain future harvest at: : LTSY. NFMA regulation 36 CFR 219.16(a)(2)(iv).
: Rotations based on 95% of : culmination of mean : annual increment	: Minimum	: Greater than: : or equal to : : 95% CMAI	: 1-15	: Allow harvest options to begin at 95% of the culmi- : nation of the mean annual increment. Ensure a : minimum tree size before final harvest. NFMA regu- : lation 36 CFR 219.16(a)(2)(iii) and the Forest : Service Manual (FSM) 2413.21.
: Low demand projection for : oil and gas and minerals : development (acres)	: Equality	: 65,500	: 1-15	: Require 65,500 acres, distributed over all analysis: : areas, to be allocated to high oil, gas, and miner- : als management goals. Since development of private: : subsurface rights are not controlled by Forest : Service, a projection or estimate was developed : that will apply to all alternatives. It will show : the effects and opportunities of oil and gas devel- : opment on surface resource development.

Table B-25 (cont.) Common and Structural Constraints for all Benchmarks

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Special Areas (acres)	Equality	5,903	1-15	Assign Tionesta Research, Tionesta Scenic Area, Hearts Content, and Kane Experimental Forest to Management Prescription 9.1 in FORPLAN. Add additional costs and outputs to 9.1 FORPLAN data. Manage area as Management Prescription 8.10. Additional costs were added because management prescription 8.10 was handled outside the model.
<u>Structural Constraints</u>				
Limit final harvest on AA's older than 90 years	Maximum (acres)	33%	1-2	Maximum of 33% of 90+ age classes in each timber type (AH, NH, and Oak) can be final harvested in period 1, and 33% in period 2. Existing volumes and regeneration problems not reflected in inventory data.
Aspen final harvest	Equality (percent)	50% 25%	1 2-6	Final harvest 50% of all acres allocated 1.1 in period 1 and 25% in periods 2-6. If management prescription 1.1 is assigned, an even distribution of age classes is required to generate the WFUD coefficients in the prescription.
Delay final harvest in oak	Maximum (acres)	0	1	Zero acres can be assigned Oak to Oak final harvest prescription in period 1. Current technology is not available to regenerate Oak.
Analysis Areas	Equality (acres)	503,306	1-15	Ensure all acres of the Forest are assigned in the model.

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Benchmark Analysis

3. Description of Individual Benchmarks

a. Benchmark 1

1) Title: Maximum Present Net Value - Market and Non-Market Outputs Valued - With a reduced set of Minimum Management Requirements

2) Purpose

We have designed this benchmark to show the effects of not meeting selected minimum management requirements (MMR's), an analysis requirement described in 36 CFR 219.27. The opportunity costs for the MMR's result from comparing this Benchmark 1 with Benchmark 2.

3) Constraints in Addition to the Common and Structural Constraints

We did not impose any constraints other than common and structural constraints. See below for list of activities deleted from this benchmark.

4) Assumptions and Model Specifications

- The objective function is maximize PNV.
- Value sawtimber, softwood roundwood, Wildlife and Fish Visitor Days, and Recreation Visitor Days.
- We have decided to address the opportunity costs for only those items which have created the greatest national concern and whose costs we have more distinctly represented in the model. The following is a brief summary of those selected for analysis:

Cost of maintaining minimum viable populations (36 CFR 219.27(a)(6)),
Cost of maintaining plant and animal diversity (36 CFR 219.27(a)(5)),
Resource protection costs (36 CFR 219.27(a)(1) thru (4), (7) and (8); 36 CFR 219.27(e); 36 CFR 219.27(f)),
Volume reductions which correspond with the MMR's for resource protection.

The analysis we conducted has captured the significant cost and yield reductions necessary to implement these MMR's (except for the soil and water activities included in stumpage prices, such as seeding, fertilizing, and installing waterbars). The Land Management Planning process records contain specific details about the constraints or activities we included or excluded when completing this analysis.

- This run does not include any resource coordination or protection activities.
- This run does not contain any timber volume adjustment which results from resource protection and coordination activities.
- Since to our knowledge all of the benchmarks maintain minimum viable populations and plant and animal diversity, there is no opportunity cost to develop for meeting these MMR's.
- This run includes the same level of non-modeled activities and outputs as Benchmark 2.

b. Benchmark 2

1) Title: Maximum Present Net Value - Market and Non-Market Outputs Valued - With Minimum Management Requirements

2) Purpose

- This benchmark serves as a point of comparison when analyzing all of the problem statements. It establishes the mix of outputs and prescriptions which maximize PNV for the Allegheny National Forest, using market values for timber and assigned values for Recreation and Wildlife Visitor Days while meeting all MMR's.
- It serves as a basis for identifying opportunity costs associated with the MMR's. Comparing Benchmark 1 with Benchmark 2 completes this analysis.
- This benchmark provides the basis for preparing the opportunity costs and trade-off analysis in the incremental analysis of alternatives.
- This benchmark fulfills the requirements in 36 CFR 219.12(e)(1)(iii) to "estimate the maximum present net value of those resources having an established market value or an assigned value".

Benchmark Analysis

3) Constraints in Addition to the Common and Structural Constraints

We did not impose any additional constraints.

4) Assumptions and Model Specifications

- The objective function is to maximize PNV.
- Value sawtimber, softwood roundwood, Wildlife and Fish Visitor Days, and Recreation Visitor Days.
- This run includes resource protection and coordination activities.
- This run includes timber volume adjustments resulting from resource protection and coordination activities.
- This run includes the mix of non-modeled activities and outputs (developed recreation, fisheries, small game, and non-game) which maximize value, a high level of outputs.

c. Benchmark 3

1) Title: Maximum Present Net Value - Market and Non-Market Outputs Valued - Delay Herbicide Use

2) Purpose

This run shows the effect on PNV and timber harvest volumes of delaying the use of herbicide for 20 years. This run addressed the "Quantities of Timber Volume" problem statement.

3) Constraints in Addition to the Common and Structural Constraints

Constraint	Purpose	Amount	Time Period	Constraint Rationale
No herbicide use for 20 years.	Show effect on PNV and Timber harvest volume of delaying use.	Maximum of 0 acres of herbicide application	1-2 years	Delay hebcicide use and wait to see if the deer browsing/understory competi-tion/regenera-tion problem subsides.

4) Assumption and Model Specifications

- If the deer herd is lowered to ecologically acceptable levels, the natural reproduction may emerge through the fern/striped maple understory without the need for chemical control. This Benchmark estimates the effects of not using herbicide for two decades based on the above hypothesis.
- The Allegheny National Forest data base does not contain any information about the spatial arrangement of the areas which have dense fern/striped maple understories. We also do not have any information on the characteristics of the analysis areas which have this understory vegetation. We do not know if it is spread evenly across all of them or if it is concentrated in areas which are not ready for harvest? Sampling completed on other studies indicates about half of the area has a significant fern/striped maple understory. For this Benchmark we have assumed it is spread evenly across all analysis areas.
- Many forest managers feel the number of acres with a dense fern/striped maple understory problem have been slowly increasing over the last 30 years. When more light reaches the forest floor, it stimulates growth of this type of understory vegetation. Research has confirmed this is occurring, but we do not have any reliable estimates of its significance Forest-wide. In this benchmark we assume 60 percent of every acre assigned a thinning intensity will require chemical control while only 50 percent of every acre assigned a final harvest intensity requires similar treatment.
- Analysis completed outside FORPLAN shows chemical control as the most cost-effective method of treating the understory vegetation. Chemical control is the only technique included in this Benchmark. Requiring mechanical techniques would produce a substantially lower PNV with the same results.
- The objective function is to maximize PNV.
- Value sawtimber, softwood roundwood, Wildlife and Fish Visitor Days, and Recreation Visitor Days.

- This benchmark includes resource protection and coordination activities.
- This benchmark includes timber volume adjustments resulting from resource protection and coordination activities.
- This benchmark contains the same level of non-modeled activities and outputs as Benchmark 2.

d. Benchmark 4

1) Title: Maximum Present Net Value - Market and Non-Market Outputs Valued - High OGM Demand

2) Purpose

- This benchmark run addressed the "Private Oil and Gas Development" problem statement.
- It shows the effect of a high level of OGM development (for reserved or outstanding mineral rights) on total PNV, resource outputs, and prescription allocation.

3) Constraints in Addition to the Common and Structural Constraints

: Constraint :	: Purpose :	: Constraint Amount :	: Time Period :	: Constraint Rationale :
:Assign high:OGM pre-:scriptions: on acres: expected to: receive: intensive: OGM: development:	:Show effect: on PNV, re-:source out-:puts, and: prescrip-:tion: assignment.:	:188,640: acres:	:Phase 1n: gradu-:ually: over 15: periods.:	:High OGM pre-:scriptions: represent in-:tensive de-:velopment. :Development: will not: occur all at: once.:

4) Assumptions and Model Specifications

- The high OGM demand is the level of development the Forest experienced between 1980 and 1982 (See Section IV.B, on demand assumptions).
- Development will not occur all at one time. We have assumed approximately 90 percent of it will occur within the first five decades, with the remainder in decades 6 thru 15.

- The objective function is to maximize PNV.
- Value sawtimber, softwood roundwood, Wildlife and Fish Visitor Days, and Recreation Visitor Days.
- Certain areas on the Forest have a higher potential for intensive OGM development than others. We have assigned these areas a higher percentage of the high OGM development prescriptions than the areas which have a low potential for development.
- This run includes timber volume adjustments resulting from resource protection and coordination activities.
- This run includes resource protection and coordination activities.
- This run includes the same level of non-modeled activities and outputs as Benchmark 2.

e. Benchmark 5

1) Title: Maximum Present Net Value - Market and Non-Market Outputs Valued - 100% RARE II Wilderness

2) Purpose

- The purpose of this benchmark is to determine potential capability to respond to the Wilderness problem statement by estimating the Wilderness capacity of the Forest.
- It shows the effect on PNV and resource outputs of assigning all of the RARE II areas (15 areas on 33,972 acres) to wilderness.

3) Constraints in Addition to the Common and Structural Constraints

Constraint	Purpose	Amount	Time Period	Constraint Rationale
Assign all RARE II areas to wilderness prescription	Show the effect on PNV and all resource outputs	33,972 acres	1-15	This benchmark emphasizes wilderness opportunities

4) Assumptions and Model Specifications

- The objective function is to maximize PNV.
- Value sawtimber, softwood roundwood, Wildlife and Fish Visitor Days, and Recreation Visitor Days.
- This run includes resource protection and coordination activities.
- This run includes timber volume adjustments resulting from resource protection and coordination activities.
- This run includes the same level of non-modeled activities and outputs as Benchmark 2.

f. Benchmark 6

1) Title: Maximum Present Net Value - Market Outputs Valued

2) Purpose

- This benchmark addresses the problem statements titled "Quantities of Timber Volume" and "Integration of Outstanding Rights Mineral Development."
- It fulfills the requirement in 36 CFR 219.12(e)(1)(iii)(A) to "include an estimate of the mix of resource uses, combined with a schedule of outputs and costs, which will maximize the present net value of those major outputs that have an established market price."

3) Constraints in Addition to the Common and Structural Constraints

We did not impose any additional constraints.

4) Assumptions and Model Specifications

- The objective function is to maximize PNV.
- Value only sawtimber and softwood roundwood and developed recreation.
- This run includes resource protection and coordination activities.
- This run includes timber volume adjustments resulting for resource protection and coordination activities.
- This run includes the same level of non-modeled activities and outputs as Benchmark 2.

g. Benchmark 7

1) Title: Maximum Present Net Value - Market and Non-Market Outputs Valued - Non-declining Sawtimber Yield

2) Purpose

- This addresses the problem statement entitled "Quantities of Timber Volume."
- Sawtimber volume is far more important to local and national markets than roundwood. Sawtimber volume fluctuates widely from decade to decade in all of the benchmarks. This benchmark shows the effect on PNV and all resource outputs of requiring a non-declining flow of sawtimber volume.

3) Constraints in Addition to the Common and Structural Constraints

Constraint	Purpose	Amount	Time Period	Constraint Rationale
Require non-declining sawtimber harvest	Show effect on PNV and all resource outputs	N/A	1-15	Sawtimber is more important than total volume in the marketplace

4) Assumptions and Model Specifications

- The objective function is to maximize PNV.
- Value sawtimber, softwood roundwood, Wildlife and Fish Visitor Days, and Recreation Visitor Days.
- This run includes resource protection and coordination.
- This run includes timber volume adjustments resulting from resource protection and coordination activities.
- This run contains the same level of non-modeled activities and outputs as Benchmark 2.

h. Benchmark 9

1) Title: Maximum Present Net Value - Non-Market Outputs Valued

2) Purpose

- This addresses all of the problem statements, with particular emphasis on the statements entitled "Mix of Recreation Opportunity" and "Wilderness Recommendations."
- It estimates the mix of WFUD's and RVD's by ROS Class which produces the highest PNV.
- This fulfills the requirement in 36 CFR 219.12(e) (1)(iii) for the wildlife, recreation, and wilderness resource areas.

3) Constraints in Addition to the Common and Structural Constraints

We did not impose any additional constraints.

4) Assumptions and Model Constraints

- The objective function is to maximize PNV.
- The objective function includes production costs for all resource areas but only the output values for WFUD's and dispersed RVD's.
- This run includes resource protection and coordination activities.
- This run includes timber volume adjustments resulting from resource protection and coordination activities.
- This run includes the same level of non-modeled activities and outputs as Benchmark 2, plus some dispersed recreation facilities which were not compatible with Benchmark 2.

i. Benchmark 10

This benchmark was done in two stages. Stage 1 established the maximum timber volume production for 50 years. Stage 2 takes the volumes determined in Stage 1 and selects the prescriptions which most efficiently produce these volumes.

Stage 1

1) Title: Maximum Timber Volume Production for 50 years

2) Purpose

- This addresses the problem statement entitled "Quantities of Timber Volume."
- It establishes the maximum biological production potential for the timber resource together with showing the associated costs and benefits. This fulfills the requirement in 36 CFR 219.12(e)(1)(ii) for the timber resource area.
- Establish the upper bound for timber resource production which sets the upper production limit for alternatives.

3) Constraints in Addition to Common and Structural Constraints

We did not impose any additional constraints.

4) Assumptions and Model Specifications

- The objective function is to maximize total timber volume production for hardwood sawtimber and roundwood and softwood sawtimber and roundwood for the first 50 years of the planning horizon.
- Sawtimber values, softwood roundwood values, values for Wildlife and Fish Visitor Days, and values for Recreation Visitor Days contribute to total PNV, but max PNV was not the objective function.

Stage 2

1) Title: Maximum Present Net Value - Market and Non-Market Outputs Valued - Maximum Timber Volume Production for 50 years

2) Purpose

- This addresses the problem statement entitled "Quantities of Timber Volume."
- It selects the prescriptions which most efficiently produce the maximum timber production levels that the maximize timber volume benchmark established for the first five decades. Therefore, it sets the most efficient mix of prescriptions to meet maximum timber volume production established in the maximize timber volume benchmark.

Benchmark Analysis

3) Constraints in Addition to the Common and Structural Constraints

Constraint	Purpose	Constraint Amount	Time Period	Constraint Rationale
In decades 1-5 require at least the volumes established in the maximize timber volume benchmark	Determine highest and most efficient prescriptions for meeting maximum timber volume	215 MMCF	1	Must require high harvest level or else model will choose a lower level
		215 MMCF	2	
		215 MMCF	3	
		215 MMCF	4	
		215 MMCF	5	

4) Assumptions and Model Specifications

- The objective function is to maximize PNV.
- Value sawtimber, softwood roundwood, Wildlife and Fish Visitor Days, and Recreation Visitor Days.
- This run includes resource protection and coordination activities.
- This run includes timber volume adjustments resulting from resource protection and coordination activities.
- This run includes the same level of non-modeled activities and outputs as Benchmark 2.

k. Benchmark 11

1) Title: Maximum Present Net Value - Market and Non-Market Outputs Valued - Minimum Level Management

2) Purpose

- This benchmark fulfills the requirements of 36 CFR 219.12(e)(1)(1) which requires the Allegheny National Forest to define "the minimum level of management which would be needed to maintain and protect the unit as part of the National Forest System, together with associated costs and benefits."

3) Constraints in Addition to the Common and Structural Constraints

Constraint	Purpose	Constraint: Amount	Time: Period	Constraint: Rationale
Require 9.1/9.11 on all acres	Determine costs and benefits associated with minimum level management of the ANF	N/A	1-15	Prescriptions 9.1 and 9.11 are the only prescriptions which adequately model minimum management

4) Assumptions and Model Specifications

- The objective function is to maximize PNV.
- Value sawtimber, softwood roundwood, Wildlife and Fish Visitor Days, and Recreation Visitor Days.
- Prescription 9.1 includes the minimum level of management required for us to administer intensive oil and gas development for reserved and outstanding mineral rights.
- This run includes resource protection and coordination activities.
- This benchmark does not contain any non-modeled activities and outputs except for induced outputs for non-game wildlife and fish which are not in FORPLAN.

k. Benchmarks 12 - 15

1) Title: Maximum RVD's by ROS class.

2) Purpose

These benchmarks are in partial fulfillment of the requirement of 36 CFR 219.12(e)(1)(ii), which requires the maximum physical potentials of significant goods to be estimated.

3) Constraint: These benchmarks were calculated outside FORPLAN.

4) Assumptions and Model Specifications:

- The maximum recreation yield by ROS class is an aggregate of the maximum dispersed RVD's, plus the maximum trail RVD's, plus the maximum developed RVD's.
- Dispersed RVD's and trail RVD's have been modeled in FORPLAN. To get the maximum potential yield for each ROS class, the high intensity production coefficient was multiplied by the total suitable acres on the Forest.
- Developed recreation RVD's have been modeled outside FORPLAN. The maximum is defined as the most intensive recreation scenario developed through the non-FORPLAN modeling process [noted in the process records as Concept I (market)].

1. Benchmark 16

- 1) Title: Current situation benchmark.
- 2) Purpose

The benchmark fulfills the requirements of 36 CFR 219.12(e)(2), which requires an estimate of the amount of goods and services produced if current management direction continues.

- 3) Constraints: See Alternative B.

4) Assumption and Model Specifications

The development of Alternative B is based on current management. The costs and outputs in Alternative B indicate the results if this direction were to continue. It is felt Alternative B fulfills the requirement for a current situation benchmark run.

m. Benchmark 17

- 1) Title: Minimum Wilderness benchmark.
- 2) Purpose

Estimate the effects on goods and services if the ANF provided no Wilderness.

3) Constraints

Allow no Wilderness management prescriptions to be selected.

4) Assumptions and Model Specifications

Any benchmark which contains no Wilderness prescription fulfills this benchmark requirement.

D. Benchmark Analysis

Not applicable - significant timber forests only.

E. Quantities of Outputs in the Max PNV Market/Non-Market Versus Max PNV Market Benchmark Runs

The maximum PNV benchmark, based on those resources with established market values, showed significant differences from the maximum PNV benchmark which included values for both market and non-market outputs. These two benchmarks are identical in all respects except in terms of outputs valued in the objective function. The non-FORPLAN portion of these two benchmarks were held constant in the analysis, therefore, any changes are a result of the FORPLAN solution.

The PNV of the Max PNV Market run is \$233 million lower (52 percent) than the Max PNV Market/Non-market run. This indicates the significant contribution that non-market outputs make to the total value of the benchmarks and alternatives. In addition, if the values of the non-market outputs were added to the Max PNV Market run, the PNV would still be \$66 million less (or 14.9 percent) than the PNV of the Max PNV Market/Non-market benchmark run. This illustrates the induced affects of each benchmark run on the allocation process.

Table B-26 compares the management prescription allocation for the two benchmarks. In the Max PNV Market benchmark run, all acres were assigned a timber harvesting prescription with the exception of those 6,000 acres constrained to special area management. Of the 503,000 total Forest acreage, 459,000 acres or 91 percent were allocated to even-aged management prescription 3. This allocation indicates that when only market outputs are valued, the even-aged management prescription of 3 and 4 (softwood) are more efficient than the uneven-aged management prescription 2 or the management prescription that emphasizes recreation and wildlife, 6.1. The allocation for the Max PNV Market/Non-Market run is also almost entirely (93%) in timber harvesting prescriptions. Approximately 35,000 acres or seven percent of the Forest is allocated to management prescriptions which do not harvest timber. Of these 35,000 acres, 6,000 represent acres constrained to special area management. The remaining 29,000 acres or six percent of the Forest was allocated to management prescription 6.1 and prescriptions which emphasize recreation and wildlife. These 29,000 acres represent areas which are marginal for timber management and are better managed for recreation and wildlife to maximize PNV.

Outputs in the Max PNV Market/Non-Market vs. Max. PNV Market Benchmark Run

A summary of selected outputs for the two benchmark runs can be found in Table B-27. As a result of valuing only market outputs, the LTSY increased from 119.0 MMBF/year to 127.0 MMBF/year. This is a result of more acres being allocated to timber harvesting prescriptions. Harvest volumes are at LTSY in both benchmarks, and the total timber volume increase between the Max PNV Market/Non-market run and the Max PNV Market run averages about 80 MMBF/decade.

A comparison of RVD's by ROS class (Table B-27) reveals that RVD's decrease in the Max PNV Market run in all categories except rural (W09). There was no change in rural RVD's because these were a result of the non-FORPLAN allocation, which was held constant between the runs. The decrease in RVD's in the three remaining ROS classes is a result of two changes in the allocation. The first was a shift in the management prescriptions. Management prescription 6.1 produces semi-primitive motorized RVD's. Management prescriptions which manage timber result in roaded-natural RVD's. Shifting from management prescription 6.1 to management prescriptions 3 and 4 caused a reduction in the number of semi-primitive motorized RVD's.

The decrease in semi-primitive motorized RVD's would have been offset by an increase in roaded natural RVD's, if not for the second significant change in the allocation. When the objective function went from valuing RVD's and WFUD's to not valuing these outputs, the recreation/wildlife intensity chosen went from generally high to generally low intensity. This caused an overall reduction in RVD's produced in all ROS classes included in the FORPLAN model (i.e., W03, W05, and W07). This reduction more than offset any increase in roaded natural RVD's that would have resulted for the shift from 6.1 to 3 and 4. In summary, the shift in intensities caused RVD's in all ROS classes, except rural, to be reduced. The simultaneous change in allocation from management prescription 6.1 to management prescription 3 and 4 caused an even larger reduction in the semi-primitive RVD's.

Wildlife and fish user days also showed a general decline between the Max PNV Market/Non-market run and the Max PNV Market run. This decline was a result of shifting from high recreation/wildlife intensities to low recreation/wildlife intensities.

Table B-26 Management Prescription Allocations for Max. PNW Market/Non-market Benchmark Run and Max. PNW Market Benchmark Run

	<u>Max. PNW: Market/Non-market</u>		<u>Max. PNW: Market</u>	
	M acres Assigned	% of Forest	M acres Assigned	% of Forest
Aspen, Grouse	1	0	0	0
Uneven-age, non-game	2	62	4	1
Even-age, turkey, deer	3	388	459	91
Even-age, softwood	4	19	34	7
Wilderness	5	0	0	0
Recreation, Wildlife	6.1/6.4	29	0	0
Even-age 10 yr SPNM 30 yr	6.2	1	1	1
Wetland wildlife	6.3	0	0	0
Long Rotation Primitive	6.5	0	0	0
Developed Recreation	7	0	0	0
Special Area	8	6	6	1
Minimum Level	9.1	0	0	0

Table B-27 Summary of Outputs for Max PNW Market/Nonmarket and Max PNW Market Benchmark Runs

	<u>Max. PNW: Market/Non-Market</u>	<u>Max. PNW: Market</u>
<u>LTSY (MMBF/Year)</u>	119.0	127.0
<u>Total Timber Volume (MMBF)</u>		
Decade 1	1193	1274
2	1193	1274
3	1193	1274
4	1193	1274
5	1193	1274
10	1193	1274
15	1193	1274
<u>Hardwood Sawtimber (MMBF)</u>		
Decade 1	491	474
2	678	776
3	715	814
4	780	800
5	891	902
10	510	608
15	566	442

Outputs in the Max PNW Market/Non-Market vs. Max PNW Market Benchmark Run

Table B-27 (con't) Summary of Outputs for Max PNV Market/Nonmarket and Max PNV Market Benchmark Runs

		<u>Max. PNV: Market/Non-Market</u>	<u>Max. PNV: Market</u>
<u>Wildlife Users Days (MWF UD's)</u>			
Decade	1	3742	3676
	2	4601	4283
	3	4978	4533
	4	5029	4588
	5	5010	4532
	10	5012	4536
	15	4978	4485
 <u>RVD's By ROS Class (MRVD's)</u>			
<u>W03: Semi-Primitive Non-motorized</u>			
Decade	1	61	50
	2	133	100
	3	154	100
	4	176	100
	5	187	100
	10	187	100
	15	187	100
 <u>W05: Semi-Primitive Motorized</u>			
Decade	1	1466	622
	2	1513	669
	3	1513	669
	4	1531	688
	5	1531	688
	10	1531	688
	15	1531	688
 <u>W07: Roaded Natural</u>			
Decade	1	13109	10544
	2	14475	10862
	3	15559	10900
	4	16974	11268
	5	17619	11390
	10	17573	11344
	15	17573	11344

Outputs in the Max PNV Market/Non-Market Vs. Max PNV Market Benchmark Run

Table B-27 (con't) Summary of Outputs for Max PNV Market/Nonmarket and Max PNV Market Benchmark Runs

		<u>Max. PNV: Market/Non-Market</u>	<u>Max. PNV: Market</u>
<u>W09: Rural</u>			
Decade	1	4353	4353
	2	6764	6764
	3	8099	8099
	4	11095	11095
	5	11095	11095
	10	11095	11095
	15	11095	11095

Outputs in the Max PNV Market/Non-Market vs. Max PNV Market Benchmark Run

F. Summary of the Benchmark Results

1. Introduction

This section presents a short summary of the important results and the significant trade-offs for each benchmark. Benchmark 2, "Maximum Present Net Value - Market and Non-Market Outputs Valued - With Minimum Management Requirements," serves as the base benchmark of comparison for all of the benchmarks. This section includes only the title and results for each benchmark.

For a description of the specific purposes and assumptions for each benchmark, see Section VI.C. Section VIII.C.2. discusses in detail the reasons for the changes in PNV from that shown for Benchmark 2.

All comparisons are made with the Max PNV Market, Non-Market Benchmark. (Benchmark 2).

2. Maximum Present Net Value - Market and Non-Market Outputs Valued - With a Reduced Set of Minimum Management Requirements (Benchmark 1)

- a. This benchmark has the highest PNV, 3% above Benchmark 2.
- b. Changes in timber receipts are more significant than changes in timber management costs.

<u>Decade</u>	<u>Timber Costs</u>	<u>Timber Receipts</u>
1	+ 2%	+ 1%
2	+ 5%	+16%
3	+ 4%	+15%
4	+ 4%	+18%
5	+ 2%	+ 1%
10	0	-26%
15	0	+28%

- c. Recreation costs average 1% lower each decade.
- d. Wildlife costs average 10% higher each decade.
- e. Long-term sustained yield increases by 10% from 119 MMBF/YR to 131 MMBF/Yr.
- f. RVD's average 2% lower each decade.
- g. Wildlife Element WFUD's average 2% higher each decade.

Summary of Benchmark Results

- h. Total volume harvested averages 10% higher in Decades 1 thru 5, 10, 15, with the following specific changes for roundwood and sawtimber.

<u>Decade</u>	<u>Sawtimber Change</u>	<u>Roundwood Change</u>
1	+ 6%	+12%
2	+12%	+10%
3	+13%	+ 6%
4	+15%	+ 3%
5	+ 7%	+25%
10	-16%	+29%
15	+30%	+16%

- i. The following prescription acreage assignments occurred:

<u>Prescription</u>	<u>Acres</u>
1 /1.11	0
2 /2.21	24,738
3 /3.41	428,785
4 /4.01	18,823
5	0
6.1/6.4	24,025
6.2	33
6.3	0
6.5	0
7	1,000
8	5,902
9.1/9.11	0

- j. The following major prescription assignment shifts from Benchmark 2 resulted:

<u>Prescription</u>	<u>Acreage Change</u>	<u>% Change</u>
2	-37,000 ac.	-61%
3	+40,700 ac.	+11%
6.1	- 3,700 ac.	-13%

- k. Acres by harvest type vary significantly from Benchmark 2.

<u>Decade</u>	<u>Final Harvest</u>	<u>Thinning</u>	<u>Selection Cut</u>
1	+ 4%	+ 34%	-61%
2	+19%		-59%
3	+34%	+ 18%	-61%
4	+26%		-59%
5	+26%	+191%	-61%

Conclusions

- a. Implementing resource coordination and protection activities results in a 3% reduction in PNV.
- b. MMR's affect prescription 3 more than 2, so 3 looks more attractive financially without MMR's.
- c. Thinning intensities are more attractive without MMR's, partially as a result of modeling limitations related to how we used the timber adjustment factor. Section III.E.1.h. explains how we used timber volume adjustment factors to account for inclusions of land which will not produce timber or which will have reduced yields for multiple-use reasons. Some of the yield reductions apply to final harvest but not thinnings, but we did not have room in the model to enter separate factors for each of these treatment types. Actually, thinning intensities should show a 4% lower volume reduction than final harvests. This would increase thinning intensity yields and make thinnings more financially attractive in Benchmark 2 and all benchmarks which include MMR's. It might then increase the amount of thinning intensities selected in Benchmark 2. The effect would be to decrease the difference in the acres of thinnings between Benchmark 1 and Benchmark 2.
- d. Timber receipts, in the benchmark without MMR's, increase more dramatically than costs, presumably because costs are more similar across all Analysis Areas than are returns from the volume harvested. Because of the wide variation in timber values, a slight increase in the volume harvested on the more valuable AA's could increase total receipts by a larger proportion.

3. Maximum Present Net Value - Market and Non-Market Outputs Valued - With Minimum Management Requirements (Benchmark 2)

- a. This benchmark serves as the base benchmark for comparison for all of the other benchmarks. Section VIII.C. displays the outputs, costs, and significant activity amounts for this benchmark.
- b. The following prescription acreage assignments occurred:

Summary of Benchmark Results

<u>Prescription</u>	<u>Acres</u>
1 /1.11	0
2 /2.21	61,688
3 /3.41	387,707
4 /4.01	19,274
5	0
6.1/6.4	27,712
6.2	23
6.3	0
6.5	0
7	1,000
8	5,902
9.1/9.11	0

4. Maximum Present Net Value - Market and Non-Market Outputs Valued - Delay Herbicide Use (Benchmark 3)

- The change in total PNV is insignificant—a decrease of 1%.
- Changes in timber receipts are more significant than changes in timber management costs.

<u>Decade</u>	<u>Timber Costs</u>	<u>Timber Receipts</u>
1	- .3%	-5.2%
2	-1.4%	+2.9%
3	-1.9%	+5.8%
4	-5.8%	-7.8%
5	-2.0%	-4.7%

- Long-Term Sustained Yield decreases 2% from 119 MMBF/YR to 117 MMBF/YR.
- Total volume harvested in the first 5 Decades averaged 2% lower each Decade, with the following specific changes for roundwood and sawtimber.

<u>Decade</u>	<u>Sawtimber Change</u>	<u>Roundwood Change</u>
1	-10%	+ 3%
2	-13%	+14%
3	+ 9%	-18%
4	+10%	-25%
5	- 2%	0

- e. The following prescription acreage assignments occurred:

<u>Prescription</u>	<u>Acres</u>
1 /1.11	0
2 /2.21	56,255
3 /3.41	385,388
4 /4.01	19,295
5	0
6.1/6.4	34,868
6.2	627
6.3	0
6.5	0
7	1,000
8	5,902
9.1/9.11	0

- f. Prescription shifts from Benchmark 2 - There is a shift of 7,200 acres from prescriptions 2 and 3 to prescription 6.1, which results in a 7,200 acre increase in the semi-primitive motorized ROS class.
- g. Acres by harvest type vary significantly from Benchmark 2.

<u>Decade</u>	<u>Final Harvest</u>	<u>Thinning</u>	<u>Selection Cut</u>
1	-31%	+13%	+26%
2	+ 9%		-73%
3	- 9%		+26%
4	+ 6%		-73%
5	- 8%		+26%

- h. WFUD's dropped 9% in the first decade, and show insignificant variation from Benchmark 2 in Decades 2 thru 5.
- i. Herbicide use drops to zero in Decades 1 and 2, but is 28% to 47% higher in Decades 3 to 5.

Conclusions

- a. The changes in total PNV and long-term sustained yield are insignificant.
- b. Though we are able to hold herbicide use to zero during Decades 1 and 2, herbicide use will increase significantly (28% to 47%) in Decades 3 to 5, if reduced deer browsing does not significantly increase crop tree regeneration.

- c. If our assumptions concerning the magnitude of the understory problem and its spatial arrangement are correct, the analysis shows we will suffer little economic or resource loss by delaying use of herbicide for 20 years. This would give us the chance to see what the effects of reduced deer browsing are on crop tree regeneration in areas having a significant fern/striped maple understory component. However, we do not have any information which will help us assess the validity of our assumptions. This is a data need we must immediately fill during implementation. We will then be in a better position to evaluate the results of this benchmark.

5. Maximum Present Net Value - Market and Non-Market Outputs Valued - High OGM Demand (Benchmark 4)

- a. Total PNW decreases 5% from Benchmark 2.
 b. The following average changes occurred in element costs, outputs, returns/values over the first five decades:

<u>Element</u>	<u>Costs</u>	<u>Outputs</u>	<u>Value</u>	<u>Receipts</u>
Timber	- 5%	See (d) below		-4%
Recreation	- 6%	RVD's -9%	-10%	
Wildlife	-29%	WFUD's -1%	- 5%	

- c. Long-term sustained yield decreases 3% from 119 MMBF/YR to 115 MMBF/YR.
 d. Total volume harvested in the first 5 decades averaged 2.7% lower.

Average sawtimber harvest = -2.3%
 Average roundwood harvest = -1.8%

- e. The following prescription acreage assignments occurred:

<u>Prescription</u>	<u>Acres</u>
1 /1.11	0
2 /2.21	43,235
3 /3.41	415,371
4 /4.01	17,348
5	0
6.1/6.4	20,428
6.2	22
6.3	0
6.5	0
7	1,000
8	5,902
9.1/9.11	0

- f. The following major prescription assignment shifts from Benchmark 2 occurred:

<u>Prescription</u>	<u>Acreage Change</u>	<u>% Change</u>
6.1	- 7300	-25%
4	- 1900	-10%
3	+27700	+ 7%
2	-18500	-30%

- g. A 7,300 acre shift from semi-primitive motorized to roaded natural coincides with the shift from prescription 6.1 to 3 shown above.
- h. Changes in the number of acres by harvest type coincided with the shift from 2 to 3, with most of the increases in 3 going to the final harvest intensity.
- i. The following shift occurs in the OGM prescription assignments:

<u>Prescription</u>	<u>Benchmark 2</u>	<u>Benchmark 4</u>	<u>Acreage Change</u>
1.11	0	0	0
2.21	33	81	+ 48
3.41	61340	182117	+120777
4.01	4347	7390	+ 3043
9.11	0	0	
TOTAL	65720	189588	+123868

Summary of Benchmark Results

- j. The following total changes occur in road construction and reconstruction financed with federal money during the first five decades:

<u>Activity</u>	<u>Change</u>		<u>Cost</u>	
	<u>In Mile</u>	<u>%Change</u>	<u>Change</u>	<u>%Change</u>
Road Constr	- 29	-12%	- 942M	-13%
Road Recon	-279	-16%	-5188M	-16%

The total miles of private and other public road construction and reconstruction will increase significantly, perhaps by as much as several hundred percent, due to the intensive private road construction which occurs in OGM developments.

- k. The total cost of OGM administration increases by \$23,070,000 or 286% in the first five decades.

Conclusions

- a. With the objective of maximizing present net value, the best management for intensive oil and gas development is prescription 3.41.
- b. The high level of OGM development we have projected results in a minor decrease in long-term sustained yield (3%) but a significant reduction in total PNW (5%) (Item c below provides insight into why PNW drops).
- c. Before making this benchmark, we wondered whether the increased road building by OGM developers on the large acreage devoted to intensive oil and gas development in the high OGM demand scenario and the decrease in our road building costs, there would result in a higher total PNW. Even though we recognize that all of the OGM costs are not related to road building, and even though we have excluded the benefits received from the sale of the privately owned minerals in the marketplace, it seemed like the PNW for the high development scenario might increase. The results of this benchmark, however, show the total cost of oil and gas administration exceeds the benefits derived from the reduced Forest Service cost road building in the intensive oil and gas development areas.

6. Maximum Present Net Value - Market and Non-Market Outputs Valued - 100% RARE II Wilderness (Benchmark 51)

- a. Total PNV decreases 3% from Benchmark 2.
- b. The following average changes occurred in element costs, outputs, returns/values over the first five decades:

<u>Element</u>	<u>Costs</u>	<u>Outputs</u>	<u>Value</u>	<u>Receipts</u>
Timber	-5%	see (d) below		-7%
Recreation	-2%	RVD's -3%	-3%	
Wildlife	-6%	WFUD's -2%	+1%	

- c. Long-term sustained yield decreases 7% from 119 MMBF/YR to 110 MMBF/YR.
- d. Total volume harvested in the first five decades averaged 7% lower each decade, with the following specific changes for roundwood and sawtimber.

<u>Decade</u>	<u>Sawtimber Change</u>	<u>Roundwood Change</u>
1	- 9%	-6%
2	-12%	0
3	- 7%	-8%
4	- 7%	-8%
5	- 7%	-5%

- e. The following prescription acreage assignments occurred:

<u>Prescription</u>	<u>Acres</u>
1 /1.11	0
2 /2.21	60,865
3 /3.41	359,673
4 /4.01	17,458
5	33,972
6.1/6.4	24,626
6.2	23
6.3	0
6.5	0
7	1,000
8	5,691
9.1/9.11	0

- f. Major prescription shifts from Benchmark 2 are the following:

<u>Prescription</u>	<u>Acreage Change</u>	<u>% Change</u>
6.1	- 3,100 acres	-11%
5	+34,000 acres	infinite
4	- 1,800 acres	- 9%
2	- 800 acres	- 1%
3	-28,800 acres	- 7%

- g. The shift of 30,700 acres from roaded natural and 3,300 acres from semi-primitive motorized to semi-primitive non-motorized corresponds with the prescription shifts shown above in item f.
- h. Acres by harvest type vary significantly from Benchmark 2.

<u>Decade</u>	<u>Final Harvest</u>	<u>Thinning</u>	<u>Selection Cut</u>
1	-12%	-3%	- 8%
2	- 9%		+10%
3	- 9%	-3%	- 8%
4	- 7%		+10%
5	- 6%		- 8%

Conclusions

- a. The primary shift which results from wilderness allocation when our objective is to maximize PNW, is the removal of land from even-aged management, prescription 3. Only 9% of the RARE II land areas were already assigned to prescriptions which preclude timber harvesting.
- b. Long-term sustained yield and timber harvest volume in the first five decades dropped significantly by 7% and PNW declines by 3%.

7. Maximum Present Net Value - Market Outputs Valued (Benchmark 6)

- a. Section VI.E. (page B-140) describes the results of this benchmark and provides a comparison with Benchmark 2.

b. The following prescription assignments occurred:

<u>Prescription</u>	<u>Acres</u>
1 /1.11	0
2 /2.21	3,832
3 /3.41	458,466
4 /4.01	34,083
5	0
6.1/6.4	0
6.2	23
6.3	0
6.5	0
7	1,000
8	5,902
9.1/9.11	0

8. Maximum Present Net Value - Market and Non-Market Outputs Valued - Non-declining Sawtimber Yield (Benchmark 7)

- a. PNV decreases 3% from Benchmark 2.
- b. Changes in timber receipts are more significant than changes in timber management costs:

<u>Decade</u>	<u>Timber Costs</u>	<u>Timber Receipts</u>
1	-23%	+ 5%
2	- 5%	+ 2%
3	-22%	-24%
4	-15%	-30%
5	-19%	-46%
10	-14%	+44%
15	-24%	+48%

- c. Long-term sustained yield decreases 14% from 119 MMBF/YR to 103 MMBF/YR.
- d. Total volume harvested in the first five decades averages 14% less each decade, with the following specific changes for roundwood and sawtimber:

<u>Decade</u>	<u>Sawtimber Change</u>	<u>Roundwood Change</u>
1	+15%	-35%
2	-15%	- 4%
3	-20%	- 4%
4	-28%	+ 5%
5	-36%	+39%
10	+26%	-33%
15	+17%	-17%

Summary of Benchmark Results

e. The following prescription assignments occurred:

<u>Prescription</u>	<u>Acres</u>
1 /1.11	0
2 /2.21	28,529
3 /3.41	388,527
4 /4.01	9,926
5	0
6.1/6.4	68,744
6.2	678
6.3	0
6.5	0
7	1,000
8	5,902
9.1/9.11	0

f. The following major prescription assignment shifts resulted from Benchmark 2:

<u>Prescription</u>	<u>Acreage Change</u>	<u>% Change</u>
6.1	+41,000 acres	+ 143%
3	+ 800 acres	0%
6.2	+ 700 acres	+2848%
2	-33,200 acres	- 54%
4	- 9,300 acres	- 48%

g. The shift of 41,700 acres from roaded natural to semi-primitive motorized (+41,000 acres) and to semi-primitive non-motorized (+700 acres) corresponds with the shift from prescriptions 2 and 4 to 6.1 and 6.2.

h. Acres by harvest type vary significantly from Benchmark 2.

<u>Decade</u>	<u>Final Harvest</u>	<u>Thinning</u>	<u>Selection Cut</u>
1	+127%	-97%	- 96%
2	+ 4%		-100%
3	+ 31%	-83%	- 96%
4	- 30%		+ 6%
5	- 26%	+23%	- 96%

i. The following average changes occurred in element costs, outputs, and values over the first five decades:

<u>Element</u>	<u>Costs</u>	<u>Outputs</u>	<u>Value</u>
Recreation	+ 2%	0	+3%
Wildlife	+13%	0	+5%

Conclusions

- a. Non-declining even flow (NDEF) of sawtimber results in a 14% decrease in the long-term sustained yield, the total volume harvested in the first five decades, and the total sawtimber volume harvested in the first five decades.
- b. Timber receipts and sawtimber volume do not change significantly in the first 2 decades, but they do decrease quite significantly in decades 3 to 5. Overall, NDEF of sawtimber seems to provide stability to timber receipts, eliminating large fluctuations between decades.
- c. NDEF of sawtimber increases the number of acres not needed for timber harvesting, with most of the decrease coming from prescriptions 2 and 4.
- d. Both thinning and selection cuts become less desirable with NDEF of sawtimber required. The increased volumes from thinnings are not needed or are not financially efficient in achieving this objective.

9. Maximum Present Net Value - Non-Market Outputs Valued (Benchmark 9)

- a. Total PNV decreased 8% from Benchmark 2.
- b. Timber receipts average 93% less and timber management costs average 84% less in the first five decades.
- c. Recreation costs, outputs, and values vary significantly from Benchmark 2.

<u>Decade</u>	<u>RVD Change</u>	<u>Value Change</u>	<u>Cost Change</u>
1	+20%	+50%	-11%
2	+13%	+40%	-11%
3	+ 9%	+34%	-11%
4	+ 5%	+28%	-10%
5	+ 4%	+26%	-11%
10	0	+26%	-11%
15	0	+26%	-11%

Summary of Benchmark Results

- d. Wildlife costs, outputs, and values vary significantly from Benchmark 2.

<u>Decade</u>	<u>WFUD Change</u>	<u>Value Change</u>	<u>Cost Change</u>
1	+ 2%	+86%	+76%
2	+ 3%	+70%	- 2%
3	+10%	+66%	- 6%
4	+21%	+74%	+19%
5	+28%	+83%	+32%
10	+31%	+85%	+28%
15	+33%	+88%	+28%

- e. Long-term sustained yield drops 92% from 119 MMBF/YR to 12 MMBF/YR.
 f. Total harvest, sawtimber harvest, and roundwood harvest all decreased 92%.
 g. The following prescription acreage assignments occurred:

<u>Prescription</u>	<u>Acreage</u>
1 /1.11	0
2 /2.21	0
3 /3.41	65,720
4 /4.01	0
5	0
6.1/6.4	430,684
6.2	0
6.3	0
6.5	0
7	1,000
8	5,902
9.1/9.11	0

- h. The following major prescription assignment shifts from Benchmark 2 occurred:

<u>Prescription</u>	<u>Acreage Change</u>	<u>% Change</u>
2	- 61,700 acres	-100%
3	-322,000 acres	- 83%
4	- 19,300 acres	-100%
6.1	+403,000 acres	+140%

- i. The shift of 403,000 acres of roaded natural to semi-primitive motorized corresponds with the shift from prescription 2, 3, and 4 to 6.1.

Conclusions

- a. Prescription 6.1 has the highest PNV for recreation and wildlife values.
- b. There is a dramatic shift from prescriptions calling for timber harvesting (2, 4, 3) in Benchmark 2 to prescription 6.1 in Benchmark 9. The only acres still assigned to timber harvesting prescriptions are those with high intensity oil and gas development. High intensity OGM prescriptions were constrained to apply to 65,720 acres. In this instance, 3.41 was assigned since it produces the highest PNV for recreation and wildlife values of all the other OGM prescriptions (1.11, 2.21, 4.01, 9.11).
- c. Maximizing the PNV of recreation and wildlife values reduces total PNV by 8%.
- d. There is a dramatic decrease in total harvest volume and long-term sustained yield of 92%.

10. Maximum Present Net Value - Market and Non-Market Outputs Valued - Maximum Timber Volume Production for 50 Years (Benchmark 10)

- a. Total PNV decreases 5% from Benchmark 2.
- b. Changes in timber management costs are more significant than the changes in timber receipts.

<u>Decade</u>	<u>Timber Receipts</u>	<u>Timber Costs</u>
1	+22%	+27%
2	- 2%	+26%
3	- 6%	+23%
4	- 1%	+29%
5	- 8%	+19%
10	- 3%	+ 3%
15	+82%	+ 9%

- c. Changes in the recreation element for the first five decades are not significant - RVD's do not change, values decrease 1% and costs increase 1%.
- d. Changes in the wildlife element for the first five decades are not significant, except for costs - WFUD's decrease 1%, values decrease 3%, and costs decrease 9%.
- e. Long-term sustained yield increases by 14% from 119 MMBF/YR to 136 MMBF/YR.

Summary of Benchmark Results

- f. Total volume harvested in the first five decades averaged 14% higher, with the following specific changes for roundwood and sawtimber:

<u>Decade</u>	<u>Sawtimber Change</u>	<u>Roundwood Change</u>
1	-14%	+33%
2	- 1%	+35%
3	+13%	+15%
4	+ 8%	+25%
5	0	+57%
10	+49%	-12%
15	+46%	+ 7%

- g. The following prescription assignments occurred:

<u>Prescription</u>	<u>Acreage</u>
1/1.11	0
2/2.21	82,731
3/3.41	377,831
4/4.01	16,568
5	0
6.1/6.4	0
6.2	0
6.3	0
6.5	0
7	1,000
8	5,902
9.1/9.11	0

- h. The following major prescription assignment shifts from Benchmark 2 occurred:

<u>Prescription</u>	<u>Acreage Change</u>	<u>% Change</u>
2	+22,000 acres	+ 36%
4	+16,600 acres	+ 86%
6.1	-28,700 acres	-100%
3	- 9,900 acres	- 3%

- i. The shift of 28,700 acres from semi-primitive motorized to roaded natural corresponds with the shift from prescription 6.1 to 2 and 4.
- j. Acres by harvest type vary significantly from Benchmark 2:

<u>Decade</u>	<u>Final Harvest</u>	<u>Thinning</u>	<u>Selection Cut</u>
1	-15%	+ 64%	+33%
2	+ 4%	+43,900 ac.	- 8%
3	-20%	+ 81%	+41%
4	0%	+64,300 ac.	0
5	-12%	+2198%	+41%

Summary of Benchmark Results

There were zero acres of thinning in Decades 2 and 4 in Benchmark 2.

Conclusion

- a. Maximizing timber volume production for the next 50 years results in a significant increase in long-term sustained yield of 14%, but a significant decrease in PNV of 5%.
- b. Costs of timber management increase at a higher rate than receipts, since areas with lower production efficiency are called into solution.
- c. To obtain the increased volume production, increases must be made to both the areas of land assigned to timber management as well as the intensity of management (more thinnings). Thinnings tend to maximize volume production over the short run (next 50 years).
- d. The effect on total recreation and wildlife RVD's is minimal, although there is a significant change in the type of experience provided.

11. Maximum Present Net Value -- Market and Non-Market Outputs Valued - Minimal Level Management (Benchmark 11)

- a. Total PNV decreases 73% from Benchmark 2.
- b. Timber outputs, costs, and receipts decrease to zero.
- c. Long-term sustained yield decreases to zero.
- d. RVD's decrease by 85%, their value decreases by 77%, and recreation management costs decrease by 99%.
- e. Wildlife costs, outputs, and values all decrease significantly: WFUD's decrease 50% and costs decrease 100%.
- f. All acres are assigned to prescriptions 9.1/9.11.

<u>Prescription</u>	<u>Acres</u>
9.1	437,586
9.11	65,720

- g. All acres shift to semi-primitive motorized except for 65,700 acres of high intensity oil and gas development which are assigned roaded natural.

Conclusions

- a. Of all outputs, WFUD's are least affected by minimum level mangement, averaging 50% less during the first 5 decades.

Summary of Benchmark Results

b. PNVD drops dramatically by 73%.

12. Maximum ROS Benchmarks (Benchmarks 12-15)

a. The table below is a summary of the ROS potential on the ANF.

b. PNVD drops dramatically by 73%.

ROS Benchmarks (in MRVD's in the 5th decade)¹

Recreation Category	12	13	14	15
	SPNM (W03)	SPM (W05)	RN (W07)	R (W09)
Disp. RVD's	1,414	14,587	8,979	0
Trail RVD's	167	1,509	5,125	0
Dev. RVD's	0	638	5,443	18,365
TOTAL MRVD's ²	1,581	16,734	19,547	19,365

13. Current Situation Benchmark (Benchmark 16)

This benchmark is met through Alternative B, which is a current situation alternative.

14. Minimum Wilderness Benchmark (Benchmark 17)

All benchmarks except Benchmarks 5, 12, and 16 have 0 acres of Wilderness and meet the requirements for the minimum Wilderness benchmarks.

1 All investments would be made within the first 50 years. Therefore, the maximum potential yield would be analyzed by the 5th decade.

2 These are not cumulative across benchmarks. Benchmarks 2 and 9 show maximum mix of ROS classes.

VII. FORMULATION OF ALTERNATIVES

A. Introduction

1. A forest planning alternative is a mix of management prescriptions applied in specific amounts to achieve desired goals and objectives.

To be viable, alternatives must:

- Exist between maximum and minimum resource potential of the Forest.
- Facilitate analysis of opportunity costs, of resource use, and environmental trade-offs among alternatives.
- Facilitate evaluation of present net value, benefits, and costs of achieving various outputs as well as values that are not assigned monetary values.
- Show a different way to address and respond to major public issues, management concerns, and resource opportunities (ICO's).
- Represent the most cost-efficient combination of management prescriptions that can meet the objectives of the alternative.
- State the condition and uses that will result from implementation.
- State what goods and services will be produced including timing and flow of outputs and the costs and benefits generated.
- State the resource management standards and guidelines used.
- State the purpose of the management direction used.

Formulating alternatives is Step 5 in the Forest planning process (page B-2), following the Analysis of the Management Situation. During the Analysis of the Management Situation, a determination was made of the ability of the Forest to respond to the Forest planning problems by supplying goods and services. Maximum and minimum output levels were established. These levels form the range within which the alternatives were developed. Two specific alternatives are required. One alternative must respond to and incorporate the RPA program tentative resource objectives.

Formulation of Alternatives

Another must reflect the current and expected level of goods and services produced should current management be continued (the "no-action" alternative). The process leading to the final set of Forest Plan alternatives can be explained in a series of steps.

Step 1 - Issues were identified through public involvement. Internal management concerns were added to the list of issues (further explained in Appendix A). These issues and concerns were reviewed by an interdisciplinary team and resulted in a set of planning problems to be analyzed in the Forest planning process.

Step 2 - A comprehensive multi-resource data base was formed based on the identified planning problems and stored in a computer retrieval system.

Step 3 - A set of management prescriptions were prepared to represent a variety of possible ways and intensities to manage the Forest in response to the Forest's planning problems.

Step 4 - Analysis areas with similar physical and biological attributes were identified and mapped. The capability, suitability, and management opportunities of specific areas of the Forest were considered in this step.

Step 5 - We developed a variety of management prescriptions as options to apply on the analysis areas identified in Step 4.

Step 6 - Resource outputs and the associated costs and dollar values that would result when a prescription was implemented were calculated and entered into the computer model FORPLAN.

Step 7 - Demand was estimated for the resources involved in the planning questions.

Step 8 - Supply potentials or benchmarks were determined using the FORPLAN computer model and through estimates made outside the model. Benchmarks were established to explore the maximum response to individual values, benefits, or outputs associated with the planning problems, to identify the biological limits for significant resources,

and to determine the most cost-efficient level of production on the Forest.

Existing resource supply and projected demand were compared to supply potentials of each benchmark. Opportunities to address the planning problems were identified by comparing existing and projected demand to potential production levels. These potentials, when compared to the Current Direction, indicate opportunities and/or need for change. This step concluded the Analysis of the Management Situation.

Step 9 - Alternative goals and objectives were established to provide a broad range of options for future management of the Forest and to provide a broad range of response to the Forest's planning problems. The range of response was limited to levels less than or equal to the supply potentials estimated in the benchmark analysis. Descriptions were written to define the resource management intent for each alternative.

Step 10 - The FORPLAN model was again used to estimate the outputs and cost for each alternative by reflecting the objective of the alternative through a given set of constraints. This step was repeated as necessary to assure the constraints were properly reflecting the objective of the alternative.

Step 11 - The results of the FORPLAN analysis for each alternative were evaluated to assure conformance with laws, policies, and guidelines. Refinements were made to insure that each alternative could be achieved.

Further information on the FORPLAN model is present in Section III of this Appendix.

The alternatives presented in the Final EIS is the product of an iterative analysis process that had its origins in the benchmark analysis. As was indicated in Section VI of this Appendix, we performed a benchmark analysis with the FORPLAN model in order to determine the Forest's potential response to the planning problems and to identify the complimentary and competitive relationships that existed among the planning problems, outputs, and constraints.

Formulation of Alternatives

An initial set of benchmarks was defined to determine the maximum response to the values, benefits, or outputs within each Forest planning problem.

The following discussion summarizes the sequence of FORPLAN runs from benchmarks to final alternatives, as well as what was learned from each situation and how it was used to make the adjustments in the sequential run.

Step 1 - Following completion of the FORPLAN data base and model calibration, initial benchmarks were run. Spatial feasibility was tested by the Districts on a portion of the Forest. Concern arose about high timber volumes and spacing of regeneration harvests. We learned what the cost-efficient solutions were for each benchmark.

Step 2 - Three plan alternatives representing a wide range of outputs were developed. District ID Team members mapped the solution on a portion of the Forest. These alternatives and maps were used at a public meeting. The public developed ideas for additional alternatives.

We also further adjusted and calibrated the FORPLAN model as a result of this step.

Step 3 - Another generation of benchmarks were run but not the complete set. We felt that the benchmarks in Step 1 above provided enough information to proceed with second generation alternatives.

Following Ranger/Staff review of benchmarks, the timber volumes were further calibrated. After several more benchmarks, we felt the model was adequately calibrated. All displayed benchmarks and alternatives were run using one data set after completion of Step 3.

Step 4 - The Forest Management Team developed the goals, objectives, and management direction for a second generation of plan alternatives. Results from previous benchmarks were used to develop the alternatives, particularly prescription assignments from the different objective functions.

FORPLAN runs were then made for each Forest Plan alternative using the goals and objectives developed by the Management Team. Solutions were mapped and adjustments were made to the FORPLAN formulations to model the spatial problems and opportunities.

Step 5 - Alternatives were developed, and the incremental constraint analysis was performed. Maps were also developed for each alternative.

See Appendix A (pages A-27 to A-35) and Appendix B, Sections VI.F. and VIII.C. for discussion of competitive and complimentary relationships among problem statements and resource potentials. Also, see the above for a discussion on what was done to assure cost-effective solutions which are feasible.

Changes Made as a Result of Comments on the Draft EIS

The analysis in this appendix has been revised and expanded to address public comments and internal concerns in the Draft EIS. Changes that effect the analysis were made in FORPLAN and outside FORPLAN.

Changes in FORPLAN:

- No herbicide use for 15 decades in Alternative B (ref. EIS Appendix C, pages C-42 to C-44);
- Change Management Area allocation in Alternative D. Add 7,000 acres of Management Area 1, removing it from Management Area 6.1. Increase Management Area 6.2 by 15,000 acres, reducing Management Area 6.1 by 15,000 acres to compensate (ref. EIS Appendix C, pages C-47 to C-50);
- Prohibit conversion from Oak to Allegheny hardwoods in Alternative D (ref. EIS Appendix C, page C-50);
- Provide for a minimum of 15,000 acres of old growth in Alternative D.

Formulation of Alternatives

Changes outside of FORPLAN:

- Provide a range of alternatives for ORV trails. The amount of planned ORV trail construction in the alternatives is Alt. A = 0 percent of 1977 ORV EIS, Alt. B = 100 percent, Alt. C = 75 percent, Alt. D = 100 percent, and Alt. E = 125 percent (ref. EIS Appendix C, Pages C-32 to C-33);
- Do not develop Sugar Bay resort but plan new motel/restaurant complex adjacent to Allegheny Reservoir Marina in the second decade in Alternative D (ref. EIS Appendix C, pages C-24 to C-28).

Other changes are made as a result of public comments and internal concerns from the Draft EIS. Those listed above are the ones affecting this appendix. For a more extensive list of the changes made as a result of comments on the Draft EIS, see Chapter 2, page 2-2 and Appendix C of the Final EIS.

B. Common Constraints

Prior to the development of alternatives, the ID Team identified the legal requirements, policy direction, and other considerations which had to be met to ensure that each benchmark and plan alternative would be feasible to implement. A set of constraints were placed on the FORPLAN model in every run to assure these requirements were met. This set of constraints did not vary throughout the analysis. Therefore, the opportunity costs or other trade-offs associated with meeting these constraints were not analyzed. The list can be broken into two types of constraints: (1) common constraints and (2) structural constraints.

Common constraints are those constraints needed to ensure that legal requirements, national and regional policy, and minimum management requirements are met. Examples include constraints to:

- Ensure a non-declining and long-term sustained yield of timber [36 CFR 219.16.(a)(1)].
- Ensure that the Allegheny National Forest has sufficient timber inventory at the end of the planning horizon to provide a perpetual harvest at the long-term sustained yield [36 CFR 219.16 (a)(2)(iv)].
- Any minimum management requirements of 36 CFR 219.27 not covered in the prescription development phase.

Structural constraints are constraints to ensure the results of the FORPLAN runs can be implemented from a technical standpoint.

Table B-28 shows the common and structural constraints developed to respond to these requirements. The table displays the constraint, the constraint kind, constraint amount, applicable time periods, and the rationale for the constraint.

The structural constraint to limit final harvest on analysis areas older than 90 years was used because of inventory errors and potential regeneration problems on the sites. We now know that many of these areas are actually much younger than TMIS data indicates and have significantly less volume than the yield tables show.

These areas also have been undesirable to regenerate in the past due to hemlock understory, wet site, or steep and rocky inclusions. If these areas are managed for timber outputs, the investments needed to overcome the regeneration problems should be spread over several decades.

Recent efforts to regenerate oak stands to the oak type have not been completely successful. Many oak stands have converted to Allegheny hardwood types despite objectives to retain the oak type. Thus, we have included a structural constraint which precludes regeneration harvests in decade 1 for prescriptions with the objective of retaining the oak type. We anticipate research results will be available by the second decade to allow retention of the oak type. Prescriptions which convert oak analysis areas to the Allegheny hardwood type do allow regeneration harvests in the first decade.

The structural constraint on aspen final harvest applies only to prescriptions 1/1.11. An even mix of aspen age classes (10, 20, 30, 40-year old) is required to provide the specified grouse habitat and, therefore, the WFUD coefficients included in FORPLAN for these prescriptions. For this reason, the constraint requires final harvest of 25 percent of the 1/1.11 aspen acreage each decade. Most of the aspen on the ANF is now 50-years old. In order to provide for a more rapid rejuvenation of these older stands, we have required final harvest on 50 percent of the 1/1.11 aspen acreage in decade 1.

With the exception of Benchmark 4, which used high instead of low OGM demand, the above common and structural constraints were applied to all benchmarks and alternatives.

TABLE B-28 COMMON AND STRUCTURAL CONSTRAINTS FOR ALL ALTERNATIVES

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Common Constraints				
Non-declining yield	Minimum	Greater than: or equal to previous decade	1-15	The planned sale for any future decade shall be equal to or greater than the planned sale for the preceding decade. This ensures a non-declining supply of timber volume throughout the planning horizon as required in the National Forest Management Act (NFMA) regulations 36 CFR 219.16(a)(1).
Long-term sustained yield	Maximum	Less than or: equal to LTSY	15	The planned sale is not greater than LTSY. This ensures the planned sale can be maintained. NFMA regulation 36 CFR 219.16(a)(1).
Perpetual timber harvest	Minimum	Greater than: or equal to LTSY	15	Forest inventory at the end of the planning horizon should be great enough to sustain future harvest at LTSY. NFMA regulation 36 CFR 219.16(a)(2)(iv).
Rotations based on 95% of culmination of mean annual increment	Minimum	Greater than: or equal to 95% CMAI	1-15	Allow harvest options to begin at 95% of the culmination of the mean annual increment. Ensure a minimum tree size before final harvest. NFMA regulation 36 CFR 219.16(a)(2)(iii) and the Forest Service Manual (FSM) 2413.21 apply.
Low demand scenario for oil gas, and minerals development (acres)	Equality	65,500	1-15	Require 65,500 acres, distributed over all analysis areas, to be allocated to high intensity oil, gas, and minerals management goals. Since development of private subsurface rights are not controlled by Forest Service, a projection or estimate was developed that will apply to all alternatives. It will show the effects and opportunities of oil and gas development on surface resource development. See Section IV.B.2.

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Common Constraints

TABLE B-28 (CONT.) COMMON AND STRUCTURAL CONSTRAINTS FOR ALL ALTERNATIVES

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Special Areas (acres)	Equality	5,903	1-15	Assign Tionesta Research Area, Tionesta Scenic Area, Hearts Content, and Kane Experimental Forest to Management Prescription 9.1. Add additional costs and outputs to 9.1 FORPLAN data. Manage area: as Management Prescription 8.1.
Structural Constraints				
Limit final harvest on AA's older than 90 years	Maximum (acres)	33%	1-2	Maximum of 33% of 90+ age classes in each timber type (AH, NH, and Oak) can be final harvested in period 1, and 33% in period 2. Existing volumes and regeneration problems not reflected in inventory data. (See narrative for a more complete explanation).
Aspen final harvest	Equality (percent)	50% 25%	1 2-6	Final harvest 50% of all acres allocated 1 in period 1 and 25% in periods 2-6. If management prescription 1 is assigned, an even distribution of age classes is required to generate the WFD coefficients in the prescription.
Delay final harvest in oak	Maximum (acres)	0	1	Zero acres can be assigned Oak to Oak final harvest: prescription in period 1. Current technology is not available to regenerate Oak. (See narrative for a more complete explanation).
Analysis Areas	Equality (acres)	503,306	1-15	Ensure all acres of the Forest are assigned in the model.

C. Development of Alternatives

1. Introduction

The NFMA regulations 36 CFR 219.12(f)(2) require that alternatives be formulated so that opportunity costs (measured by the reduction in Present Net Value between sequential model runs) and resource and environmental trade-offs can be evaluated between plan alternatives and within each alternative. The analysis of trade-offs between alternatives is discussed in Section VIII.C. The procedure for evaluating the opportunity costs and trade-offs within an alternative is through incremental constraint analysis with FORPLAN. The incremental analysis procedures are discussed in this section while the results of the analysis are discussed in Section VIII.D. In incremental analysis, constraints or sets of related constraints are added to the model one at a time. Each time a new constraint or constraint set is added, FORPLAN is run and a new prescription assignment, subject to the additional constraints, is determined. Summarizing the costs, outputs, and effects of the new prescription assignment, and comparing these results to the previous runs (just prior to adding the additional constraints) provides an estimation of the opportunity cost, and resource and environmental trade-offs produced by the new constraints.

Constraints are used to ensure that output amounts, effects, and forest conditions will be produced to achieve the particular purposes, goals, and objectives of a plan alternative. When possible, the constraints which address the same problem statements are grouped into sets. This allows an evaluation of the effects produced by attempting to resolve the problem statements.

The sequence in which constraint sets are added to the model is based on their expected impact on the solution. The sets which are expected to have the most impact are the first to be added.

The constraints used to formulate alternatives are separated into four categories: (1) constraints needed to meet MMR's, (2) constraints needed to meet general timber harvest policy in the NFMA regulations, (3) constraints to ensure technical feasibility, and (4) constraints to achieve multiple-use objectives.

Development of Alternatives

Constraint categories 1 and 2 are generally referred to as common constraints. Category 3 constraints are structural constraints, and category 4 constraints are discretionary constraints. The common and structural constraints were discussed in VII.B. The first 3 categories are always constraint set 1 in the iterative process of alternative development.

The following section discusses the addition of discretionary constraints for each alternative. For each alternative its purpose, relationship to benchmarks, and relationship to problem statements is stated. In the discussion of the relationship of the alternatives to the problem statements is a description of the objectives which require FORPLAN constraints to achieve their desired outcome. Objectives are grouped by problem statements. Objectives addressing the same problem statements will be grouped together as a "problem statement objective set." The discretionary constraints developed as a result of each set of objectives will also be displayed and grouped as a constraint set. The constraint, constraint kind, constraint amount, applicable time period, and constraint rationale will be displayed in tabular form. The objective set and their constraint sets will be displayed in the order in which the constraint sets are placed on the model. The problem statement objective set and the constraint set will be numbered the same, i.e., problem statement objective set 2 is addressed by the constraints in constraint set 2. For each constraint set, PNV, change in PNV, total discounted costs, total discounted benefits, and discounted cost and benefits by decision variables are displayed. A more detailed display of costs, outputs, and effects can be found in Section VIII.C. and D.

2. Discussion of Individual Alternatives

a. Alternative A

1) Purpose

This alternative will emphasize high levels of production of non-market outputs. The alternative will produce a high level of recreation user satisfaction for those desiring large expanses of the Forest in a natural-appearing condition. Substantial opportunities will be provided for semi-primitive recreation.

Market outputs will remain close to current levels, but timber volumes may be lower than current levels in the early decades.

2) Relationships to Benchmarks

Alternative A is derived from the benchmark which maximizes PNV with only non-market outputs valued. Additional constraints are added to maintain a minimum level of timber harvesting.

3) Relationships to Problem Statements

a) Quantities of Timber Volume

Timber volume is allowed to fall twenty percent lower than current levels. Selection management will be used extensively, and long rotations (with final harvest beginning at age 120) will be used on areas managed under the even-aged system.

Current levels of diversity will be maintained. Conversion of oak stands is not allowed. Manage 11,000 acres of aspen intensively for grouse production. No even-aged management is allowed on steep slopes or bottomland AA's.

- Timber Problem Statements - Objective Set #2

- Timber management will aim at producing high-quality hardwood sawtimber but at a level below current.
- Total timber volume will be reduced from current levels.

- Timber Problem Statements - Constraint Set #2

- See Table B-29.

b) Recreation Mix

Large acreages will be assigned semi-primitive ROS prescriptions. The Allegheny Reservoir Face will receive prescription 6.1. For aesthetic purposes, selection management will be used extensively, and long rotations (greater than 120 years) will be used where even-aged management is assigned.

Small-scale, rustic campgrounds will be provided near water attractions and at major trailheads throughout the Forest. No new development will be provided on the Allegheny Reservoir, except for bank fishing trails.

- Recreation/Wildlife Problem Statements - Objective Set #3
 - Provide a setting which affords recreation users an opportunity for solitude and few encounters with motorized vehicles forest-wide. Small-scale facilities will be scattered throughout the Forest to disperse use. Financial efficiency is secondary to providing widely scattered recreation use.
 - Management for fish and wildlife will be intensive for both game/non-game species which favor a mature northern hardwood timber type.
 - Emphasis will be on growing timber to at or near pathological rotation versus economic rotation.

- Recreation/Wildlife Problem Statements - Constraint Set #3
 - See Table B-30.

- Additional Rationale for Alternative A Recreation/Wildlife - Constraint Set #3
 - Allegheny Reservoir Face management: Manage the Reservoir Face to provide a semi-primitive motorized setting with a VQO of Retention. Make high investments for recreation and wildlife, assigning prescription 6.1.
 - Buzzard Swamp management: Continue current intensive riparian/waterfowl management in the core area of Buzzard Swamp in cooperation with the Pennsylvania Game Commission.
 - Wildlife and Fish management: Management for wildlife will be intensive and emphasize both game and non-game species which favor large expanses of mature and old-growth northern hardwoods. Habitat improvement will include permanent grassy openings, openings planted with fruit-producing shrubs, and conifer plantings. Identify, protect, and where necessary, enhance 100 turkey wintering areas. These areas should be more or less uniformly located across the Forest.

We will not emphasize achieving high acreages of final harvest to help maintain a high deer herd.

c) Wilderness/NRA

Provide the amount of Wilderness and NRA acreage as designated in the PA Wilderness Act of 1984.

- Wilderness/NRA Problem Statements - Objective Set #4

- Provide Wilderness area consistent with legislation. This includes areas known as Hickory Creek and the Allegheny River Islands.
- Provide NRA consistent with legislation. This includes Allegheny National Recreation Area.

- Wilderness/NRA Problem Statements - Constraint Set #4

- See Table B-31.

4) Incremental Analysis Table

See Table B-32.

Table B-29 ALTERNATIVE A - Timber Problem Statements - Constraint Set #2

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Sawtimber Volume (MMBF/decade)	Minimum	100	1-15	Hardwood sawtimber will be greater than 100 MMBF per decade. Allow sawtimber to be reduced below current levels. The maximum reduction allowed is 60% of current.
Total Volume (MMBF/decade)	Maximum	411	1-15	Total volume will be equal to or less than 65 MMBF (411 MMBF). This reduces total volume to 20% below current level of 520 MMBF/decade.
No Oak conversion (acres)	Maximum	0	1-15	Zero acres of Oak Analysis Areas will be allocated a conversion prescription. Management direction is to maintain the oak type for wildlife and vegetative diversity.

Table B-30 ALTERNATIVE A - Recreation/Wildlife Problem Statements - Constraint Set #3

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Allegheny Reservoir Face Management (acres)	Equality	8,695	1-15	Assign all acres of Allegheny Reservoir Face to management prescription 6.1. Provide and maintain sem-primitive motorized opportunity around reservoir. See additional rationale for Alternative A constraint set 3.
Harvesting Restrictions on Steep and Bottomland (acres)	Maximum	0	1-15	Assign 0 acres of steep and bottomland Analysis Areas to management prescriptions 1, 3, 4, and 6.2. To maintain visual quality, soil, and water objectives, do not practice even-aged management on these sites.
Buzzard Swamp Management (acres)	Equality	782	1-15	Assign core area of Buzzard Swamp to 9.1. Continue intensive management in Buzzard Swamp. Add additional costs and outputs to 9.1 FORPLAN data. Manage area as management prescription 6.3. See additional rationale for Alt. A constraint set 3.
Aspen/Grouse Management (acres)	Equality	11,374	1-15	Assign management prescription 1 to 11,374 acres. This includes all existing aspen sites and Dog Trial area. Intensively manage these areas for grouse.
Wildlife and Fish Management (acres)	Equality	503,306	1-15	Constrain all acres of the Forest to receive high Recreation/Wildlife (R/W) intensity. Intensively manage wildlife. See additional rationale for Alternative A constraint set 3.
Harvest Age	Minimum	Greater than or equal to culmination of MAI \$	1-15	Limit final harvest to no earlier than culmination of mean annual increment of value per acre. Ensure more larger trees per acre for aesthetic reasons.

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Development of Alternatives

Table B-31 ALTERNATIVE A - Wilderness/NRA Problem Statements - Objective Set #4

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Wilderness Areas (M acres)	Equality	10	1-15	Require Hickory Creek and the Allegheny River Islands to be assigned management prescription 5.
NRA (M acres)	Equality	23	1-15	Require Allegheny Front, Complanter, and Tracy Ridge to be assigned management prescription 6.1, high intensity.

Table B-32: INCREMENTAL ANALYSIS OF ALTERNATIVE A (in M\$)
 (Only FORPLAN Costs/Outputs Included)

Constraint Set	Net Values		Costs		Benefits		Discounted Cost by Element					Discounted Benefit by Element						
	PW	ΔPW	PV	ΔPV	PV	ΔPV	Rec	Wld	Wldlf	Tbr	CGM	Support	Rec	Wld	Wldlf	Tbr	CGM	Support
1 Max PW benchmark	444	-65	101	-47	539	-110	8	0	17	71	2	3	157	0	22	359	1	1
2 Timber	379	-15	54	3	429	-9	5	1	16	27	2	3	240	1	48	140	1	1
3 Rec/Wldlf	364	-5	57	1	420	-3	6	0	13	34	2	3	248	0	46	125	1	1
4 Wilderness/NRA	359		58		417		6	1	12	34	2	3	241	4	45	126	1	1

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Development of Alternatives

b. Alternative B

1) Purpose

This alternative will emphasize continuation of current management direction. Small increases will occur in timber volumes and developed recreation. Thus, slight increases will occur in returns to the treasury and local governments. Areas not needed for timber production will be managed for dispersed recreation and wildlife.

2) Relationships to Benchmarks

Alternative B represents the Current Situation.

3) Relationships to Problem Statements

a) Quantities of Timber Volume

Timber volumes will be constrained to the 1980 RPA targets, and approximately the same ratio between sawtimber and roundwood will be retained. To meet agreements between the Forest Service and Pennsylvania Game Commission, even-aged final harvest acreages must exceed 20,000 acres per decade.

To maintain diversity, no oak conversions will be allowed. Softwood conversions will not be allowed on the low stocked AA's.

- Timber Problem Statements - Objective Set #2

- Intensively manage the timber resources to increase the sustained supply of timber products, especially high-quality hardwoods.
- Emphasize the production of timber crops through applying even-aged management.

- Timber Problem Statements - Constraint Set #2

See Table B-33.

b) Recreation Mix

A mix of recreation opportunities will be provided. Developed recreation will be emphasized over dispersed,

however, only one new facility will be provided on the Allegheny Reservoir.

Investment levels for recreation/wildlife prescription intensities will be low.

- Wildlife/Recreation Problem Statements - Objective Set #3

- Dispersed recreation will occur forest-wide. In several natural-appearing areas, dispersed and primitive recreation will be the primary management objective.
- Emphasize wildlife management for game species with minimal investments to provide public big-game hunting opportunities.

- Recreation/Wildlife Problem Statements - Constraint Set #3

See Table B-34.

c) Wilderness/NRA

Provide the amount of Wilderness and NRA acreage as designated in the PA. Wilderness Act of 1984.

- Wilderness/NRA Problem Statements - Objective Set #4

- Provide Wilderness Area consistent with legislation. This includes areas known as Hickory Creek and the Allegheny River Islands.
- Provide NRA consistent with legislation. This includes Allegheny National Recreation Area.

- Wilderness/NRA Problem Statements - Constraint Set #4

See Table B-35.

d) Public Review of Draft EIS

No herbicide use for 15 decades.

- Public review of Draft EIS - Objective Set #5

- Based on public review of the Draft EIS, Alternative B was changed to reflect no herbicide use for 15 decades.

Development of Alternatives

Alternative B was chosen since it models the current situation and herbicides are not used as a standard regeneration activity on the Forest.

- Public review of Draft EIS - Constraint Set #5

See Table B-36.

4) Incremental Analysis Table

See Table B-37.

Table B-33 ALTERNATIVE B - Timber Problem Statements - Objective Set #2

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Hardwood Sawtimber (percent of total volume)	Minimum	45%	1-15	Constrain hardwood sawtimber to comprise at least 45% of total sale volume. Historically the percent of hardwood sawtimber as a percent of total volume is approximately 50 percent.
Meet RPA Targets for Timber Sale (MMEF)	Minimum	60+ 10%	1	RPA targets are the best estimates of the Forest's current timber sale objectives.
		61+ 10%	2	
	Maximum	61+ 10%	3	
		62+ 10%	4	
		63+ 10%	5	
Final Harvest Acres (acres)	Minimum	20,000	1-15	Maintain final harvest acreage from agreement with Pennsylvania Game Commission.
No oak Conversion (acres)	Maximum	0	1-15	Zero acres of oak assigned to a conversion prescription. Current direction is to maintain the oak type for wildlife and vegetative diversity.
No Conifer Management on Low-stocked Areas (acres)	Maximum	0	1-15	Assign 0 acres to management prescription 4.0 on low-stocked analysis areas. The Forest currently does not plant conifers, except for wildlife cover.

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Table B-34: ALTERNATIVE B - Recreation/Wildlife Problem Statements - Objective Set #3

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Recreation and Wildlife Intensity (acres)	Maximum	0	1-15	Assign 0 acres to medium and high recreation and wildlife intensities. We have defined the low intensity as the current situation.
Allegheny Reservoir Face Management (acres)	Equality	8,965	1-15	Assign management prescription 9.1 to the Allegheny Reservoir Face. Maintain visual quality objectives and recreation potential in the Reservoir Area. No new facilities would be developed. Existing facilities around reservoir would continue as currently managed.
Buzzard Swamp Management	Equality	782	1-15	Assign the core area of Buzzard Swamp to management prescription 9.1. Continue intensive management in Buzzard Swamp. Add additional costs and outputs to 9.1 FORPLAN data. Manage area as management prescription 6.3. Continue current intensities riparian/waterfowl management in cooperation with the Pennsylvania Game Commission.

Table B-35 ALTERNATIVE B - Wilderness/NRA Problem Statements - Constraint Set #4

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Wilderness Areas (M acres)	Equality	10	1-15	Require Hickory Creek and the Allegheny River Islands to be assigned management prescription 5.
NRA (M acres)	Equality	23	1-15	Require Allegheny Front, Complanter, and Tracy Ridge to be assigned management prescription 6.1, medium intensity.

Table B-36 ALTERNATIVE B - Public Review of Draft EIS - Constraint Set #5

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
No ground application of herbicide	Maximum	0	1-15	Based on public comment of the Draft EIS Alternative B was no herbicide, modified to use

Table B-37 INCREMENTAL ANALYSIS OF ALTERNATIVE B (in MM\$)
 (Only FORPLAN Costs/Outputs Included)

Constraint Set	Net Values		Costs		Benefits		Discounted Cost by Element					Discounted Benefit by Element						
	PNV	Change in PNV	PV	Change in PV	PV	Change in PV	Rec	Wild	Wildlf	Trb	OGM	Support	Rec	Wild	Wildlf	Trb	OGM	Support
1 Max PNV benchmark	444	-44	101	-33	539	-75	8	0	17	71	2	3	157	0	22	359	1	1
2 Timber	400	-76	68	-18	464	-92	6	0	18	29	2	3	289	0	40	213	1	1
3 Rec/Wildlf	324	-8	50	-4	372	-10	3	0	1	40	2	4	134	0	22	215	1	1
4 Wilderness/NRA	316	-20	46	-3	362	-23	3	1	1	36	2	3	139	4	25	192	1	1
5 Public Review (No Herbicide)	296		43		339		3	1	1	33	2	3	137	4	24	172	1	1

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Development of Alternatives

c. Alternative C

1) Purpose

This alternative will emphasize high levels of production of outputs with market-established prices. Significant increases will occur in sawtimber volumes and receipt-producing recreation, which will produce high levels of revenue for the U.S. Treasury and local governments. The private sector will develop most new recreation development.

2) Relationships to Benchmarks

Alternative C is derived from the Max PNW Market Benchmark. In addition to the benchmark constraints, non-declining sawtimber volumes are required.

3) Relationship to Problem Statements

a) Quantities of Timber Volume

Quantities of timber volume will increase substantially from current levels. To maintain stable volume and receipts, provide a non-declining, even flow of sawtimber and total volume. Even-aged management is used almost exclusively.

In the FORPLAN formulation, allow oak conversions on all sites and allow reforestation prescriptions on all low stocked AA's.

- Timber Problem Statements - Objective Set #2

Intensively manage timber crops for the highest value hardwood sawtimber species yielding the highest discounted returns to the treasury.

- Timber Problem Statements -- Constraint Set #2

See Table B-38.

b) Recreation Mix

Nearly all of the ANF will be managed in the roaded-natural ROS class. Timber management prescriptions will generally not be assigned to the "seen-area" around the Allegheny Reservoir.

Expansion of existing facilities and new campgrounds will be provided on the Allegheny Reservoir. Two resorts will be provided by private capital.

High investment prescription intensities will not be allowed for recreation/wildlife. Exceptions will be allowed surrounding developed recreation areas. If a hunting/fishing stamp is passed, revenues will be used to develop wildlife/fish habitat.

Three campgrounds will be constructed in the river corridors. One each in the Allegheny, Clarion, and Tionesta corridors.

- Recreation/Wildlife Problem Statements - Objective Set #3

- Provide new dispersed and more primitive recreation opportunities only in small areas surrounding the major recreation facilities.
- Enhance big-game hunting opportunities through timber management activities only. (No C element wildlife habitat improvement unless volunteer groups do the work).

- Recreation/Wildlife Problem Statements - Constraint Set #2

See Table B-39.

- Additional Rationale for Alternative C Recreation/Wildlife Constraint Set #3

Recreation and Wildlife Intensities: Recreation management will be concentrated around the Allegheny Reservoir and the major rivers and streams.

Allocating 0 acres to medium and high recreation/wildlife intensities means a low emphasis on dispersed recreation forest-wide. Access facilities for dispersed activities will only be provided to enhance use of developed sites.

Provide small, natural-appearing areas for dispersed activities around developed facilities. These areas would provide activities such as day-hiking, bridle trails,

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cross-country skiing, interpretive trails, ORV trails, downhill ski areas, etc.

Provide only the increase in hunting opportunity which results from the vegetative manipulation associated with timber harvesting. Investment in wildlife habitat improvement projects will be minimal.

Fish and wildlife habitat improvement projects will be accomplished only by volunteer groups.

c) Wilderness/NRA

Provide the amount of Wilderness and NRA acreage as designated in PA Wilderness Act of 1984.

- Wilderness/NRA Problem Statements - Objective Set #4
 - Provide Wilderness Area consistent with legislation. This includes areas known as Hickory Creek and the Allegheny River Islands.
 - Provide NRA consistent with legislation. This includes Allegheny National Recreation Area.

- Wilderness/NRA Problem Statements - Constraint Set #4

See Table B-40.

4) Incremental Analysis Table

See Table B-41.

Table B-38 ALTERNATIVE C - Timber Problem Statements - Constraint Set #2

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Non-declining Even Flow of Sawtimber	Minimum	Greater than or equal to previous decade	1-15	Offer for sale a non-declining yield of hardwood sawtimber volume. Provide high-quality hardwoods emphasizing production of black cherry through even-aged silvicultural management system.

Table B-39 ALTERNATIVE C - Recreation/Wildlife Problem Statements - Constraint Set #3

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Recreation and Wildlife Intensities (acres)	Maximum	0	1-15	Allocate 0 acres to the medium and high recreation and wildlife intensities. Little emphasis is to be placed on dispersed recreation and wildlife investments in this alternative. See additional rationale in Alternative C constraint set 3.
Buzzard Swamp (acres)	Equality	782	1-15	Assign core area of Buzzard Swamp to management prescription 9.1. Continue intensive management in Buzzard Swamp. Add additional costs and outputs to 9.1 FORPLAN data. Manage area as management prescription 6.3.
Allegheny Reservoir Face Management (acres)	Minimum	6,086	1-15	Manage at least 70% of Allegheny Reservoir Face under a management prescription other than even-aged management. Cannot manage more than 30% even-aged and retain recreation experience levels associated with Alternative C.

Table B-40 ALTERNATIVE C - Wilderness/NRA Problem Statements - Constraint Set #4

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Wilderness Areas (M acres)	Equality	10	1-15	Require Hickory Creek and the Allegheny River Islands to be assigned management prescription 5.
NRA (M acres)	Equality	23	1-15	Require Allegheny Front, Complanter, and Tracy Ridge to be assigned management prescription 6.1, low intensity.

Table B-41 INCREMENTAL ANALYSIS OF ALTERNATIVE C (in M\$)
(Only FOREPLAN Costs/Outputs Included)

: Constraint Set :	: Net Values :		: Costs :		: Benefits :		: Discounted Cost by Element :					: Discounted Benefit by Element :						
	: PNW :	: Change:	: in PNW:	: Change:	: PNW :	: Change:	: Rec :	: Wld :	: Wldlf :	: Tbr :	: CGM :	: Support:	: Rec :	: Wld :	: Wldlf :	: Tbr :	: CGM :	: Support:
:1 Max PNW	: 444 :	:	: 101 :	:	: 539 :	:	: 8 :	: 0 :	: 17 :	: 71 :	: 2 :	: 3 :	: 157 :	: 0 :	: 22 :	: 359 :	: 1 :	: 1 :
: benchmark	:	: -25 :	:	: -14 :	:	: -38 :	:	:	:	:	:	:	:	:	:	:	:	:
:2 Timber	: 418 :	:	: 87 :	:	: 501 :	:	: 7 :	: 0 :	: 19 :	: 57 :	: 2 :	: 3 :	: 166 :	: 0 :	: 28 :	: 306 :	: 1 :	: 1 :
:	:	: -65 :	:	: -18 :	:	: -81 :	:	:	:	:	:	:	:	:	:	:	:	:
:3 Rec/Wldlf	: 353 :	:	: 69 :	:	: 420 :	:	: 4 :	: 0 :	: 0 :	: 60 :	: 2 :	: 4 :	: 95 :	: 0 :	: 5 :	: 318 :	: 1 :	: 1 :
:	:	: -16 :	:	: -1 :	:	: -15 :	:	:	:	:	:	:	:	:	:	:	:	:
:4 Wilderness/NRA	: 337 :	:	: 68 :	:	: 405 :	:	: 4 :	: 1 :	: 0 :	: 58 :	: 2 :	: 3 :	: 99 :	: 4 :	: 9 :	: 291 :	: 1 :	: 1 :

d. Alternative D

1) Purpose

This alternative will emphasize significant increases in both market and non-market outputs. Substantial increases are planned for timber and revenue-producing recreation which will result in increasing revenues for local governments and the U.S. Treasury. Several large areas of semi-primitive recreation will be provided.

2) Relationship to Benchmarks

Alternative D is based upon the Max PNV Market - Non-Market benchmark. It differs from that benchmark in two fundamentally different ways: (1) Non-declining yields (NDY) of sawtimber are required and (2) several large areas of semi-primitive recreation are required.

3) Relationship to Problem Statements

a) Quantities of Timber Volume

Quantities of timber volume must be greater than the current situation.

To maintain stability of the local timber industry and revenues to local government, provide a non-declining flow of hardwood sawtimber and total volume. Rotation ages will be selected by FORPLAN to meet the NDY constraints.

To maintain diversity, retain low-site oak in the oak type and do not allow timber management prescriptions on the low-stocked areas.

- Timber Problem Statements - Objective Set #2

- Total harvest of quality hardwood sawtimber volume is greater than at present.
- Practice no timber management on at least the 15% of the Forest which is to provide developed and dispersed recreation opportunities.
- Intensively manage the timber resource outside of the natural-appearing areas to produce high-quality, high value hardwood sawtimber in the most efficient manner.

- Provide for a sawtimber harvest which capitalizes on current age class distribution.
- Due to large deer herd and resulting reforestation problems expected in periods 1 and 2, increase final harvest acres in these periods. Also, implement a modest increase of final harvesting in the first decade to begin to spread out age class distribution.
- Timber Problem Statements - Constraint Set #2
See Table B-42.
- Additional Rationale for Alternative D Timber - Constraint Set #2
 - Require a Minimum of 420 MMBF of Sawtimber in Periods 1 thru 5: The Management Team decided to increase the harvest levels above levels shown in constraint set #1. By increasing allowable harvests in periods 1 thru 5, the Forest can capitalize on the age class distribution that now exists on the Forest.
 - Final Harvest 30,000 acres in Periods 1 and 2
Removing the non-declining even flow sawtimber constraint will result in significantly fewer acres (less than 30,000) of final harvest cutting. The large acreage shown after imposing constraint set #1 is not feasible to implement. The Management Team desires to begin final harvesting a significant acreage now to prevent the majority of them from reaching pathological maturity all at one time. Thirty thousand acres is the most we feel we can successfully regenerate in the short run until we have resolved the deer impacts and overcome the fern/striped maple regeneration problems.
 - Conversion prescriptions: Emphasize increasing the timber age class diversity for wildlife but allow a reduction in vegetative diversity. Retain low site oak in the oak type and low-stocking.

b) Recreation Mix

Manage at least 15 percent of the ANF in a semi-primitive ROS prescription.

Emphasize developed facilities only on the east side of the Allegheny Reservoir. Expand and develop new campgrounds only on the east side of the Allegheny Reservoir.

Take advantage of water attraction and provide access and campground facilities in Allegheny, Clarion, and Tionesta River Corridors.

Medium investment level intensities will be provided for recreation and wildlife.

- Recreation/Wildlife Problem Statements - Objective Set #3
- Provide opportunities for recreational experiences in highly developed sites near major water features in settings that are easily accessible yet natural-appearing.
- Manage at least 15 percent of the Forest as large, natural-appearing areas where the major emphasis is to provide a semi-primitive recreation experience.
- Emphasize providing an increased amount of hunting opportunity for deer and turkey within areas managed to provide timber outputs.
- Assign the large semi-primitive areas to those locations on the Forest best suited for this use.
- Recreation/Wildlife Problem Statements - Constraint Set #3
- See Table B-43.
- Additional Rationale for Alternative D Recreation/Wildlife Constraint Set
- Allegheny Reservoir Area: Establish an area surrounding the Reservoir which would include the following: (25,281 acres)

- Tracy Ridge (9,141 acres)
- Cornplanter (3,074 acres)
- The Reservoir Face which includes the visual corridor, but not to exceed 1/2 mile from the shoreline

All of the land within the Proclamation Boundary on the west side of the Reservoir, including land greater than 1/2 mile from the shoreline

- Emphasize developed recreation management on the east bank, maintaining the west bank in an undeveloped condition. Assign the high recreation and wildlife management intensity for management prescription 6.1 to the entire Allegheny Reservoir Management Area.

Provide large natural-appearing areas (primarily in ROS classes of semi-primitive) for dispersed recreation: Manage 15 percent of the Forest to provide a semi-primitive recreation experience, including some designated Wilderness. Assign the following large areas to management prescriptions with a semi-primitive ROS class (5, 1, 9.1).

- One large, contiguous area containing 28,678 acres whose boundary includes the Hickory Creek (8,936 acres), Allegheny Front (7,505 acres), and Minister Valley (1,967 acres) RARE II areas. The boundary would also border State Game Lands Number 29.
- Another area known as the Clarion River RARE II area (4,291 acres).

- Constrain Major River Corridors to Management Prescription 6.1

These areas receive high dispersed recreation use and are sensitive travelways. Since we have a substantial acreage assigned to prescriptions calling for no timber harvesting, it would be more appropriate to assign it to the most sensitive recreation corridors on the Forest.

- Wildlife Management Intensity: Emphasize a high intensity of wildlife habitat improvement on areas assigned timber management prescriptions by requiring at least 150,000 acres of the high recreation and wildlife intensity. Assign high intensity, non-game, wildlife habitat improvement to the 30,000 acres which include or immediately surround the developed recreation sites and the large, dispersed use, recreation areas.
- Aspen/Grouse Management: Maintain the current aspen acreage, but not necessarily on the present sites. Manage this acreage intensively for grouse production.
- Buzzard Swamp Management: Continue with current level of intensive management for waterfowl and riparian wildlife species within the Buzzard Swamp core area in cooperation with the Pennsylvania Game Commission.

c) Wilderness/NRA

Provide the amount of Wilderness and NRA acreage as designated in the PA. Wilderness Act of 1984.

- Wilderness/NRA Problem Statements - Objective Set #4
 - Provide Wilderness Area consistent with legislation. This includes the area known as Hickory Creek and the Allegheny River Islands.
 - Provide NRA consistent with legislation. This includes Allegheny National Recreation Area.
- Wilderness/NRA Problem Statements - Constraint Set #4
 - See Table B-44.

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d) Constraint Set #5¹

This constraint set was added to enhance the spatial arrangement of the solution.

- Constraint #5 - Objective Set #5

- Based on preliminary mapping and spatial feasibility testing, constrain prescription assignments to improve the spatial arrangement of prescriptions.

- Constraint Set #5 - Constraint Set #5

See Table B-45.

- Additional Rationale for Alternative D - Constraint Set #5

- Constrain Management Prescription Allocations

We made these shifts using district input to enhance the spatial arrangement of the solution. To provide some modeling flexibility, we permitted FORPLAN to vary this acreage assignment by +/- 10%.

We wanted to maintain the integrity of the remaining FORPLAN prescription assignment acreages, but allow flexibility for minor changes.

e) Public Review of Draft EIS

This constraint set was added after public review of the Draft EIS.

1 This constraint set was added after the selection of the preferred alternative in the Draft EIS. It was decided not to remove it after public review. To do so would have masked the effects public review had on revising Alternative D from the Draft to the Final EIS. Therefore, constraint set 5 was retained and constraint set 6 was added to reflect public comments.

- Public Review - Objective Set #6

- Based on public review of the Draft EIS, several constraints were added to the model. This constraint set identifies those constraints.

Public Review - Constraint Set #6

See Table B-46

Additional Rationale for Alternative D - Constraint Set #6

- Constrain Management Prescription Allocation

Many respondents felt there should be more even-aged management and less acres devoted to semi-primitive recreation, while others felt there should be more emphasis on semi-primitive recreation areas. The sportsmen felt there should be some acreage assigned to management prescription 1. As a result, seven thousand acres of management prescription 1 were added, removing it from management prescription 6.1. To increase both semi-primitive non-motorized recreation and even-aged management, management prescription 6.2 was increased by fifteen thousand acres and management prescription 6.1 reduced by a similar amount.

4) Incremental Analysis Table

See Table B-47.

Table B-42 ALTERNATIVE D - Timber Problem Statements - Constraint Set #2

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Require a minimum of 420 MEF of sawtimber in periods 1-5	Minimum	420 MEF	1-5	Increase harvest of sawtimber volume in periods 1-5. See additional rationale for Alternative D Constraint set #2.
Final harvest 30,000 acres in periods 1 and 2	Minimum	30,000 ac.	1-2	Increase final harvest until deer population declines. See additional rationale for Alternative D Constraint Set #5.
Conversion Prescriptions (acres)	Maximum	0	1-15	Zero acres of low site oak assigned to conversion prescriptions. Zero acres of low-stocked analysis areas assigned timber management prescriptions. Maintain existing amount of oak and aspen land/savannahs for vegetative and wildlife habitat diversity.

Table B-43 ALTERNATIVE D - Recreation/Wildlife Problem Statements - Constraint Set #3

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Allegheny Reservoir Management Area (acres)	Equality	25,281	1-15	Assign management prescription 6.1 high intensity R/W to 25,281 acres including Tracy Ridge and Cornplanter. Establish an Allegheny Reservoir recreation management area. See additional rationale for Alternative D constraint set 3.
Provide large Natural-Appearing Areas for Dispersed Recreation (acres)	Equality	57,288	1-15	Assign management prescription 5, 6.1, or 9.1 to 57,288 acres which is made up of Hickory Creek, Allegheny Front, Minister Valley, and adjoining area; Clarion River. See additional rationale for Alternative D Constraint set #3.
Constrain major river corridors to management prescription 6.1	Minimum	20,000	1-15	These areas are best suited to be managed with emphasis on dispersed recreation. See additional rationale for Alternative D Constraint Set #2.
Wildlife Management Intensity (acres)	Maximum	0	1-15	Constrain low and high R/W intensities to 0 acres for all timber management prescriptions. Emphasize deer and turkey on areas assigned a timber management goal. See additional rationale for Alternative D constraint set 3.
Buzzard Swamp Management (acres)	Equality	782	1-15	Assign core area of Buzzard Swamp to 9.1. Continue intensive management in Buzzard Swamp. Add additional costs and outputs to 9.1 FORPLAN data. Manage area as management prescription 6.3. See additional rationale for Alternative D constraint set 3.

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Table B-44 ALTERNATIVE D - Wilderness/NRA Problem Statements -- Constraint Set #4

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RAITONALE
Wilderness Areas (M acres)	Equality	10	1-15	Require Hickory Creek and the Allegheny River Islands to be assigned management prescription 5.
NRA (M acres)	Equality	23	1-15	Require Allegheny Front, Complanter and Tracy Ridge to be assigned management prescription 6.1, high intensity.

Table B-45 Alternative D - Constraint Set #5

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Constrain Management Prescription Allocation				
Management Prescription 1.1	Maximum	0	1-15	Increase the acres allocated to management prescription 3. Reduce acres allocated to management prescription 6.1. See additional rationale for Alternative D Constraint Set #5.
Management Prescription 2.2	Minimum	6,000	1-15	
	Maximum	8,000	1-15	
Management Prescription 3.4	Minimum	280,000	1-15	
	Maximum	342,000	1-15	
Management Prescription 4.0	Maximum	0	1-15	
Management Prescription 5.5	Minimum	8,000	1-15	
	Maximum	10,000	1-15	
Management Prescription 6.2	Minimum	5,000	1-15	
	Maximum	7,000	1-15	
Management Prescription 6.1	Minimum	146,000	1-15	
	Maximum	178,000	1-15	
Management Prescription 6.5	Maximum	0	1-15	
Management Prescription 9.1	Minimum	8,000	1-15	
	Maximum	10,000	1-15	

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Table B-46 Alternative D - Public Review of DEIS - Constraint Set #6

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
		(acres)		
Constrain Management Prescription Allocation				
Management Prescription 1	Minimum	6,500	1-15	See additional rationale for alternative 1) constraint set #5.
	Maximum	7,500		
Management Prescription 2	Minimum	5,500	1-15	
	Maximum	6,500	1-15	
Management Prescription 3	Minimum	326,500	1-15	
	Maximum	327,500	1-15	
Management Prescription 4	Maximum	0	1-15	
Management Prescription 6.2	Minimum	19,500	1-15	
	Maximum	20,500	1-15	
Management Prescription 6.1	Minimum	123,500	1-15	
	Maximum	124,500	1-15	
Management Prescription 6.5	Maximum	0	1-15	
Final Harvest a maximum of 30,000 acres in decade 1 and 2.	Maximum	30,000 (acres)	1-2	
Reduce hardwood sawtimber volume	Minimum	347,000 (MBF)	1	Because there will be no oak conversion, sawtimber volume in decade 1 is reduced
Provide for old growth in management prescription 3 and 6.2	Minimum	15,000 (acres)	5-15	Provide for old growth requirements in the standard and guidelines
Harvest oak to oak	Maximum	3,000 (acres)	1	It is possible to regenerate oak to oak on 3,000 acres of the oak timber type
No oak conversion	Maximum	0 (acres)	1-15	Maintain vegetative diversity

Table B-47 INCREMENTAL ANALYSIS OF ALTERNATIVE D (in M M\$)
 (Only FORPLAN Costs/Outputs Included)

Constraint Set	Net Values			Costs			Benefits			Discounted Cost by Element					Discounted Benefit by Element				
	PNV	Change in PNV	FV	Change in FV	FV	Change in FV	Rec	Wild	Wildf	Tbr	CGM	Support	Rec	Wild	Wildf	Tbr	CGM	Support	
1 Max PNV benchmark	444	-2	101	-1	539	-3	8	0	17	71	2	3	157	0	22	359	1	1	
2 Timber	442	-36	100	-26	536	-58	7	0	20	68	2	3	150	0	24	360	1	1	
3 Rec/Wildf	406	-5	74	-1	478	-5	6	0	9	54	2	3	153	0	22	301	1	1	
4 Wilderness	401	-3	73	-3	473	-5	5	1	9	53	2	3	149	4	22	296	1	1	
5 Const Set #5	398	-14	70	8	468	-6	5	1	10	49	2	3	164	4	27	271	1	1	
6 Public Review	384		78		462		5	1	10	57	2	3	156	4	26	274	1	1	

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e. Alternative E

1) Purpose

This alternative emphasizes significant increases in the production of both market and non-market outputs. Substantial increases in timber production will occur but with a special emphasis on visual quality. Significant acreage will be provided for semi-primitive recreation opportunities, and additional developed facilities will be provided.

2) Relationship to Benchmarks

Alternative E is based upon the Max PNW Market-Non-Market benchmark, but many enhancements were made to address problem statements, particularly recreation and wilderness. Alternative E represents the RPA benchmark.

3) Relationship to Problem Statements

a) Quantities of Timber Volume

Provide more timber volume than the current situation. Provide non-declining yields of total timber volume but allow sawtimber volumes to fluctuate. Both even and uneven-aged management will be widely used, and long rotations (greater than 120 years) will be used on areas under even-aged management.

To manage for timber production on the best AA's, do not allow even-aged timber management on low site oak or northern hardwood AA's. Practice intensive management on areas under even-aged management.

For wildlife purposes, manage aspen intensively for grouse production on at least 9,500 acres.

- Timber Problem Statements - Objective Set #2

- Provide a more natural-looking recreation setting by managing at least 25% of the Forest assigning prescriptions which use either uneven-aged management or no large-scale timber harvesting.
- Practice intensive even-aged timber management on the best sites and use longer rotations to produce high-quality, large diameter sawtimber.
- Maintain at least the current level of sawtimber harvest volume.

- Timber Problem Statements - Constraint Set #2

See Table B-48.

- Additional Rationale for Alternative E Timber Constraint Set

- Prescription and Timber Management Intensity Restrictions: Manage intensively for high-quality sawtimber on the most productive sites (medium and well-stocked high CAP and high site oak analysis areas) emphasizing even-aged management. To reduce the amount of clearcutting, manage the poorer sites (low CAP and low site oak analysis areas) by applying prescriptions calling for either uneven-aged management (2 & 6.5) or no timber harvesting (5,

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6.1, & 9.1). When using the even-aged silvicultural system, manage intensively, making intermediate cuts as soon as there is operable volume. Emphasize the double rotation concept where possible. (See Allegheny Hardwood Silvicultural Guidelines. In summary, the method requires removing intolerants at an earlier age than tolerants. Enough intolerants are left in the stand to ensure successful regeneration to high percentages of intolerants.)

- Timber Type Conversions: Allow a reduction in vegetative type and wildlife habitat diversity from the current situation. Retain low site oak in the oak type, but allow high site oak to convert to Allegheny Hardwoods. Make the following kinds of timber type conversions if applying them will maximize present net value, subject to all other management direction: 1) convert low-stocked analysis areas to conifers and 2) convert high site oak to Allegheny Hardwoods. In order to retain oak types, do not convert any low site oak to conifers and do not plant any Allegheny Hardwoods on low-stocked analysis areas.
- Hardwood Sawtimber Volume for Sale: Forest strives to increase the sale of high-quality timber products to the long-term sustained yield of the timber resource, within the limits established by the management direction for the other resource areas. Begin by harvesting at least the current sawtimber volume in decade 1 (25 MMBF/year).
- No requirement for non-declining yield of sawtimber volume.

b) Recreation Mix

Roaded-natural will be the predominant ROS class, but special emphasis will be placed on visual quality. Long rotations (greater than 120 years) will be used on all areas under even-aged management. Selection management will be used extensively. No even-aged prescriptions will be assigned to the Allegheny Reservoir area.

Many new campgrounds and access areas will be provided near the water attractions of the Allegheny Reservoir, Allegheny River, Clarion River, and Tionesta Creek. A

scenic highway will be constructed along the west side of the Allegheny Reservoir and will access a proposed resort facility at Hodge Run.

Allow high wildlife and recreation prescription intensities on at least 180,000 acres.

- Recreation/Wildlife Problem Statements - Objective Set #3

- Provide opportunities for recreation experiences in highly developed sites near major water features in settings that are easily accessible.
- Emphasize non-motorized recreation experiences (including wilderness) in several large areas totaling to 7 percent (or 35,000 acres) of the Forest.
- Emphasize providing an increased amount of hunting opportunity for deer and turkey within areas managed to provide timber outputs, using high investment intensities.
- Increase the opportunity for recreation users to view non-game species by concentrating habitat improvement in areas with high recreation use.

- Recreation/Wildlife Problem Statements - Constraint Set #3

See Table B-49.

- Additional Rationale for Alternative E Recreation/Wildlife Constraint Set 3

Minimum Rotation Age: The primary objective guiding timber management decisions is to harvest timber on a longer rotation, thereby emphasizing large diameter, high-quality sawtimber production. Revenues and financial efficiency (present net value analysis) are secondary objectives.

To provide more areas with larger trees, use rotation ages which exceed the point where culmination of mean annual increment (CMAI) of dollar value occurs. This is well beyond the point where CMAI of total merchantable cubic volume occurs, as defined in 36 CFR 219.16(a)(2)(iii) and in FSM 2412.54.

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- Reservoir Face Management: Manage the Allegheny Reservoir Face to provide a natural setting by excluding all prescriptions which call for even-aged management (1, 3, 4, and 6.1).
 - Wildlife Management Intensity: Emphasize providing increased hunting opportunities for deer and turkey through increasing the management intensity on areas assigned timber management prescriptions.

Use medium intensity prescriptions to accomplish habitat improvements, emphasizing volunteer and user group construction and maintenance whenever possible.

- Buzzard Swamp Management: Continue the current level or intensive management for waterfowl and riparian wildlife species within the Buzzard Swamp core area in cooperation with the Pennsylvania Game Commission.

c) Wilderness/NRA

Provide the amount of Wilderness and NRA acreage as designated in PA Wilderness Act of 1984.

- Wilderness/NRA Problem Statements - Objective Set #4
 - Provide Wilderness Area consistent with legislation. This includes the areas known as Hickory Creek and the Allegheny River Islands.
 - Provide NRA consistent with legislation. This includes Allegheny National Recreation Area.
- Wilderness/NRA Problem Statements - Constraint Set #4

See Table B-50.

4) Incremental Analysis Table

See Table B-51.

Table B-48 ALTERNATIVE E - Timber Problem Statements - Constraint Set #2

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Prescription Restrictions (acres)	Maximum (acres)	0	1-15	Constrain low-site oak, and low CAPS - medium and high-stocking analysis areas to 0 acres of management prescriptions 1, 3, 4, and 6.2. Reduce clearcutting to provide a more natural setting. See additional rationale for Alternative E constraint set 2.
Timber Type Conversions (acres)	Maximum (acres)	0	1-15	Constrain low-site oak to 0 acres of management prescription 4 and low-stocked analysis areas to 0 acres of management prescriptions 3 and 6.2. Allow some reduction in vegetative and wildlife habitat diversity. See additional rationale for Alternative E constraint set 2.
Timber Management Intensity Restrictions (acres)	Maximum	0	1-15	Constrain 0 acres to receive final harvest-final harvest intensity of management prescription 3.4. When assigning even-aged silvicultural system, practice intensive timber management. See additional rationale for Alternative E constraint set 2.
Hardwood Sawtimber Volume for Sale (MEF/decade)	Minimum	250	1	Require 250 MEF to be sold in period 1. Offer at least the current volume sold of high-quality hardwoods. See additional rationale for Alternative E constraint set 2.

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Table B-49: ALTERNATIVE E - Recreation/Wildlife Problem Statements - Constraint Set #3

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Minimum Rotation Age	Minimum	Greater than or equal to culmination of MAI of \$	1-15	Do not harvest prior to culmination of mean annual increment of dollar value. Emphasize large diameter high-quality sawtimber. See additional rationale for Alternative E constraint set 3.
Reservoir Face Management (acres)	Equality	8,695	1-15	Assign all acres of Allegheny Reservoir Face to management prescriptions 2, 5, 6.1, 6.5, or 9.1. Allow no even-aged management on Reservoir. See additional rationale for Alternative E constraint set 3.
Minister Valley (acres)	Equality	1,967	1-15	Assign all acres of Minister Valley to management prescription 6.1/9.11. Emphasize non-motorized recreation and allow no timber harvest in this area. See additional rationale for Alternative E constraint set 3.
Wildlife Management Intensity (acres)	Minimum	180,000	1-15	Assign a minimum of 150,000 acres of high R/W management intensities in management prescriptions 2, 3, 4, 6.2, and 6.5 and at least another 30,000 acres to any management prescription. Emphasize deer, turkey, and non-game management. See additional rationale for Alternative E constraint set 3.
Aspen/Grouse Management	Minimum	9,664	1-15	Assign 1/1.11 to at least 9,664 acres. Intensively manage at least existing aspen acres for grouse. See additional rationale for Alternative E constraint set 3.
Buzzard Swamp Management (acres)	Equality	782	1-15	Assign core area of Buzzard Swamp to management prescription 9.1. Continue intensive management in Buzzard Swamp. Add additional costs and outputs to 9.1 FORPLAN data. Manage area as management prescription 6.3. See additional rationale for Alternative E constraint set 3.

Table B-50: ALTERNATIVE E - Wilderness/NRA Problem Statements - Constraint Set #4

CONSTRAINT	CONSTRAINT KIND	CONSTRAINT AMOUNT	APPLICABLE TIME PERIOD	RATIONALE
Wilderness Area (M acres)	Equality	10	1-15	Require Hickory Creek and the Allegheny River Islands to be assigned management prescription 5.
NRA (M acres)	Equality	20	1-15	Require Allegheny Front, Cornplanter, and Tracy Rudge to be assigned management prescription 6.1, high intensity.

Table B-51: INCREMENTAL ANALYSIS OF ALTERNATIVE E (in M\$)
 (Only FORELAN Costs/Outputs Included)

Constraint Set	Net Values		Costs		Benefits		Discounted Cost by Element					Discounted Benefit by Element						
	PNV	ΔPNV	PV	ΔPV	PV	ΔPV	Rec	Wild	Wildlf	Tbr	OCM	Support	Rec	Wild	Wildlf	Tbr	OCM	Support
1 Max PNV benchmark	444	-15	101	2	539	-11	8	0	17	71	2	3	157	0	22	359	1	1
2 Timber	429	-50	103	-14	528	-59	8	0	15	75	2	3	169	0	23	335	1	1
3 Rec/Wildlf	379	-6	89	-2	469	-7	8	1	12	64	2	3	202	1	27	238	1	1
4 Wilderness/NRA	373		87		462		8	1	11	62	2	3	200	4	29	227	1	1

VIII. ESTIMATING EFFECTS OF BENCHMARKS, DISCRETIONARY CONSTRAINTS, AND ALTERNATIVES

A. Introduction

The purpose of identifying, estimating, and displaying the effects of each benchmark, discretionary constraint, and alternative is to understand the relationship between achieving certain output levels, allocations, or schedules and the trade-offs that occur in terms of PNV, discounted costs, and discounted benefits.

B. Process for Testing Constraints

In linear programming analysis, constraints override the objective function. Thus, if a predetermined level of outputs or minimum physical condition is entered as a constraint, it is always achieved or no feasible solution is found. Output levels or other desired effects entered as constraints for an alternative are implicitly assigned to contribute more to public benefits than the sum of their cost of production plus the foregone contribution of public benefits of any output they replace in solution in that alternative. Ensuring that this assumption is reasonable requires carefully documenting such trade-offs and, in the case of major constraints, displaying the effects on PNV and the resource implications.

NFMA regulations 36 CFR 219.12(f)(8) states that each alternative must represent the most cost-efficient combination of management prescriptions that can meet the objectives of the alternative. In order to meet this requirement of cost-efficiency, the objective function used in the development of the alternatives was to maximize present net value. Given that maximizing PNV is the measure of cost-efficiency used in alternative development subject to any constraints imposed, the allocation of prescriptions in any alternative will represent the most cost-efficient mix of prescriptions and level of activities and outputs.

The NFMA regulations further state in Sections 36 CFR 219.12(f)(3) and 36 CFR 219.12(g)(4) that each alternative be formulated to identify the significant opportunity costs of constraints associated with achieving alternative resource objectives and define the opportunity costs of constraints associated with resource outputs or conditions that are not assigned monetary values but are supplied at specific levels.

An incremental analysis was used to estimate trade-offs and opportunity costs within an alternative. Ideally, each constraint should be added individually in a variety of sequences. However, due to the number of constraints, the computer costs of runs, and the time involved to make such an analysis, adding each constraint separately is not feasible.

Therefore, individual constraints were placed into constraint sets which addressed a problem statement.

These constraint sets were then added in the same sequence for all alternatives. The results were that the opportunity costs and resource trade-offs to resolve each problem statement could be identified for each alternative. The order in which constraint sets are applied could affect the results. In the incremental analysis done on the ANF, the constraint sets were added in the following order and did not vary by alternative. The first constraint set added was the common and structural constraint set, which had the same constraints for all alternatives. The second constraint set added addressed the timber problem statement. The third constraint set added addressed the recreation and wildlife problem statement. The fourth constraint set added addressed the wilderness problem statement.

Non-priced outputs are resource outputs, effects, or conditions that are not assigned monetary values, but in conjunction with priced outputs, make up the total net public benefits of an alternative. Non-priced outputs are outputs for which there is no available transaction evidence and no reasonable basis for estimating market values. Non-priced benefits, as well as some outputs or factors associated with non-priced benefits, are presented in Section VIII.C.(1). The non-priced benefits include on-site outputs or effects such as visual quality objectives, ROS distribution, and eagle nesting sites and distributive effects such as impact on local jobs and income.

Section VIII.C.(1) examines the trade-offs of differences in non-priced benefits among alternatives. For on-site, non-priced benefits or effects, the gains and losses can be considered as substitutes for priced benefits.

The distributive effects or impacts also involve gains or losses among alternatives. These need to be examined on their own merits. They also should be examined in terms of the associated changes in net priced benefits and the on-site, non-priced benefits to assess the desirability of the indicated trade-off. These comparisons are judgmental indicators of net public benefits for each alternative and of the desirability of the changes in distributive benefits and losses, among alternatives.

C. Analysis of Trade-Offs Between Alternatives

1. Define the consequences of each alternative with respect to ICO's, resource outputs, economic effects....

Each forest plan alternative addresses the problem statements in different ways. This section contains a discussion of the trade-offs resulting from these different approaches to problem resolution. The discussions are organized by problem statement. Trade-offs are presented by alternative within the content of the problems. Because of the multi-resource trade-offs within each problem, discussions could be redundant between problems. To avoid duplication, most of the trade-offs regarding timber versus recreation will be discussed only once, in the timber problem statement.

Financial effects and trade-offs will be mentioned in this section, but the focus will be on resource trade-offs. A more detailed discussion of the financial consequences of alternatives is presented in Section VIII.C.2.

More detailed discussions of trade-offs caused by FORPLAN constraints is contained in Section VIII.D. Some of those effects are used to develop the discussions in this section.

Problem Statement: Vegetation Management

How should vegetation be managed to provide the most desirable quantity of high-quality timber products, habitat for a rich diversity of wildlife species, and an attractive setting for recreation activities?

Yields of Hardwood Volume

Total hardwood volume in the first decade varies between Alternative A's 489 MMBF to Alternative C's 1,026 MMBF. Total volume in the fifth decade varies between 489 MMBF in Alternative A to 940 MMBF in Alternative C. See Table B-52.

Table B-52 Hardwood Volume in Decades 1, 2, and 5 for Each Plan Alternative (in MMBF)

	<u>Alternatives</u>															<u>Benchmark</u>		
	<u>A</u>			<u>B</u>			<u>C</u>			<u>D</u>			<u>E</u>				<u>2</u>	
<u>Decade:</u>	<u>Saw:</u>	<u>Round:</u>	<u>SUM:</u>	<u>Saw:</u>	<u>Round:</u>	<u>SUM:</u>	<u>Saw:</u>	<u>Round:</u>	<u>SUM:</u>	<u>Saw:</u>	<u>Round:</u>	<u>SUM:</u>	<u>Saw:</u>	<u>Round:</u>	<u>SUM:</u>	<u>Saw:</u>	<u>Round:</u>	<u>SUM:</u>
1	:197:	292	:489:	264:	359	:623:	536:	490	:1026:	383:	562	:945:	311:	579	:890:	530:	726	:1256
2	:165:	324	:489:	345:	278	:623:	536:	490	:1026:	462:	483	:945:	280:	610	:890:	717:	527	:1256
5	:330:	159	:489:	407:	263	:623:	536:	404	:940:	653:	292	:945:	663:	227	:890:	930:	322	:1252

The most significant trade-off with various levels of timber harvest is the character of recreation settings provided. In Alternative A, 306,000 acres are assigned prescriptions with semi-primitive ROS categories, and 197,000 acres in the roaded natural category. This alternative provides the lowest timber volumes and the lowest PNV in the timber element. See Tables 52 and 53.

Table B-53 PNV of Timber and Recreation Elements by Alternative (MM\$)

	<u>Alternative</u>						<u>Benchmark</u>
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>2</u>	
<u>Recreation</u>	: 265 :	207	: 206 :	234	: 311 :	275	:
<u>Timber</u>	: 90 :	139	: 241 :	222	: 161 :	295	:

Conversely, Alternative C provides the highest timber volume and the fewest acres in the more highly valued semi-primitive ROS category. It also has the lowest recreation element PNV of any of the alternatives we considered. When comparing recreation element PNV's, two factors confound the analysis: (1) developed recreation costs/outputs are included and (2) different intensities of recreation investment are assigned in each alternative.

Trade-offs between recreation and timber are of a different nature in Alternative E. Acres in timber producing prescriptions are split nearly evenly between prescriptions 3 and 2. Some forest managers and forest users believe that areas managed under uneven-aged management provide higher levels of visual quality than areas managed under even-aged management. Uneven-aged management also provides visual diversity. Neither of these non-priced effects were assigned values in this analysis.

The trade-offs of assigning the relatively high levels of 2 in Alternative E are significant. Total timber volumes are higher than current, but sawtimber volumes are relatively low. (See Table B-52). This occurs because of the high proportions of pulpwood removed in the earlier entries under selection management. Additionally, the PNV of the timber element is relatively low because: (1) the high proportion of pulpwood removed in the early decades, (2) the high transportation costs associated with selection management, and (3) delayed regeneration harvests in prescription 3.

Non-declining Yield

Alternatives A, B, D, and E require non-declining yields (NDY) of total timber volume, while Alternative C requires both NDY of total volume and NDY of hardwood sawtimber volume. No analysis was performed to estimate the effect of non-declining yield of total volume, but the NDY constraint was always binding, thus, it constrained the PNV of each alternative.

The trade-off of the lower volumes and PNV caused by the policy of NDY is stability of the local timber industry. Because of the diversity of the area's economy and the Allegheny National Forest's relatively small contribution to timber supply, the positive effects on forest industry stability are not expected to be great.

Because of the abundance of roundwood in the area, ensuring non-declining yields of sawtimber volume has been suggested as being more important to industry stability than NDY of total volume. Thus, a constraint requiring a NDY of hardwood sawtimber volume was used in Alternatives C and initially in Alternative D (later removed). In Alternative C, the constraint reduced the PNV by seven percent, slightly reduced total harvest volume but increased hardwood sawtimber volume by 13 percent in the first decade when compared to the max PNV benchmark run with MMR's. Since fewer acres were needed for timber production, the constraint caused a 40,000 acre shift from prescription 2 to 6.1. Thus, the constraint caused the addition of 40,000 acres of semi-primitive non-motorized recreation. Finally, acres clearcut doubled in the first decade. The same effects

occurred in Alternative D but precise effects were masked by additional constraints. Because of the effects of NDY of sawtimber, the constraint was later removed for Alternative D.

Rotation Lengths

Objectives for Alternatives A and E include lengthening rotation ages in prescription 3 to produce the aesthetic effect of larger trees. Constraints to produce this effect caused beginning regeneration harvest ages to begin at age 120 rather than age 60-70 in other alternatives.

Quantification of the aesthetic benefits of providing larger trees for viewing is not possible. The primary trade-off of this constraint is the large increase in uneven-aged management. Because of lengthening rotation ages in prescription 3, prescription 2 becomes more financially competitive with 3.

The uneven-aged harvests are also needed early in the planning horizon to maintain NDY while the analysis areas in 3 grow to age 120.

Understory Control

The Forest completed an Environmental Analysis of understory control on May 6, 1982. (Appendix D in the Forest Plan contains excerpts from this document.) Applying herbicide is the most effective technique for controlling understory vegetation. It works on all target species, is least costly, and meets soil, water, health, and safety objectives. In each alternative, timber harvesting prescriptions require chemical treatment on half of every acre assigned a regeneration harvest treatment under even or uneven-aged management. Thus, the amount of acres herbicided varies directly with the acres of regeneration harvests. As a result of public review of the Draft EIS, Alternative B was revised to eliminate herbicide use. This requirement results in only half the forest being available for even or uneven-aged management in Alternative B.

Table B-54 displays the acres of herbicide use for each alternative. For additional explanation of the understory control problem, see the timber problem statement discussion in Appendix A.

Table B-54 Acres of Herbicides Use for Each Alternative

: Decade :	: Alternative (M acres) :					: Benchmark :
	A	B	C	D	E	
: 1 :	31	0	28	20	48	30
: 2 :	29	0	28	18	31	36
: 5 :	14	0	19	22	17	34

Alternative B is the only alternative requiring no herbicide use. At first glance, because there is less even-aged management in Alternatives A and E, one might expect those alternatives to require fewer acres of herbicide use. But, herbicides will also be required in uneven-aged management schemes and more acres of prescription 2 are required to obtain timber volumes equal to 3. Thus, Alternatives A and E also require relatively high amounts of herbicide use, with Alternative E requiring the highest of any alternative.

Alternatives with higher levels of herbicide use will have slightly higher risks of accidents involving herbicides with the possibility of water quality problems. The environmental effects section (Chapter 4 of the Final EIS) provides additional discussion on the risks and effects of herbicide use.

In the "Delay Herbicide Use" benchmark run (Run #3), we attempted to demonstrate the effect on PNV and timber yields of waiting 20 years before we begin to apply any herbicide. The 20-year waiting period would allow us time to see if the lower deer browsing pressure we expect results in improved natural regeneration, as some folks expect. A discussion of the results of this run is in Section VI.F.4. The results would apply to the alternatives as well. Briefly, the results are as follows:

- PNV is slightly lower if we do not apply herbicides until Decade 3.
- Over the short run, we can continue to cut relatively high volumes of timber by shifting to more thinnings and fewer final harvests.
- If regeneration does not start to occur naturally at the end of 20 years, we will have to apply much higher amounts of herbicide in Decades 3 to 5 in order to maintain timber harvest levels.

If regeneration does start to come in naturally as deer browsing decreases, we will be able to avoid using any herbicide.

Many people believe (though there is no research which either confirms or refutes this theory) that the decrease in deer browsing pressure will not be significant enough to have any effect on crop tree regeneration. They also feel that thinning or selection cutting actually increases the fern/striped maple understory cover as more light reaches the forest floor. If lower deer browsing pressure does not result in much improved crop tree regeneration, we will have to follow one of the following courses of action:

- drastically reduce harvest volumes after Decade 2,
- apply a substantial amount of herbicide in Decades 3 to 5 on those areas which have heavy fern/striped maple cover,
- develop an alternative method for economically treating fern/striped maple.

At this point, we do not have enough good inventory data on the location and magnitude of the fern/striped maple problem to realistically assess the validity of our assumptions and confidently select one of the conclusions shown above. Collecting this data will be a top priority for forest plan implementation and monitoring. In the interim, it seems most prudent to begin a herbicide application program. If management concerns preclude effective herbicide use and regeneration success does not improve, we will have to either find an alternative treatment technique or else reduce harvest volumes over the long run.

Reforest Sparsely Stocked AA's

None of the alternatives required assigning prescriptions to reforest low stocked analysis areas. Alternative B does not allow prescription 4 to be applied in low stocked AA's, and Alternative D does not allow prescription 3 to be assigned on those AA's.

Table B-55 displays the acres of low stocked AA's which will be returned to timber production by being assigned prescription 4 and 3.

Table B-55 Acres Returned to Timber Production

<u>Alternative</u>	<u>Acres of Low Stocked AA's Assigned to Prescriptions 3 or 4</u>
A	6,000
B	6,000
C	11,000
D	0
E	8,000
<u>Benchmark 2</u>	4,000

These prescriptions were assigned to these AA's to maintain non-declining flow of timber volumes. Thus, reducing the acres assigned these prescriptions would reduce PNW and the level of non-declining timber volume. Trade-offs of making these prescription assignments include:

- possible loss in the non-priced effect of vegetative diversity, since these areas are currently openings,
- possible reduction in the non-priced effect of visual quality, because these areas provide visual diversity, and
- increases in the timber element budget.

Problem Statement: What mix of recreation opportunities and settings should be provided to best satisfy the diverse preferences of recreationists?

Facility Development

The amount, scale, and location of developed facilities vary within each alternative. These strategies were developed outside of the FORPLAN model. Public involvement was used to identify a full spectrum of developed recreation intensities desired. Objectives for Alternative A emphasize providing dispersed recreation opportunities and small-scale campgrounds with rustic facilities that are distributed widely across the forest.

Alternatives C, D, and E emphasize developed recreation opportunities with various amounts of modern facility recreation areas along the Allegheny Reservoir and major river corridors (Allegheny, Clarion, and Tionesta). See Table B-56 for a comparison of developed facilities in each alternative.

In Alternative C, private investment is encouraged for resort type development as well as some campground facilities. Alternatives E and D include private investment but to a lesser extent. See Table B-57 for an estimate of the cost of private investments for each alternative.

Table B-56 Comparison of Developed Recreation Facilities

: PROPOSED ACTIVITY	ROS	ALTERNATIVES				
	CLASS	A	B	C	D	E
<u>Expand Existing</u>						
Dewdrop	R			X	X	
Webbs Ferry	R			P		P
Willow Bay	R			P	X	X
KPIC	R			X	X	
*Sugar Bay Boat Launch ¹	RN		X			
*Minister Creek	RN	X				X
<u>New Facility Construction</u>						
*Allegheny River Area	RN	X			X	X
*Bear Creek Area	RN	X			X	
*Salmon Creek Area	RN	X				X
*S. Br. Tionesta Area	RN	X				X
*Kinzua Ridge Area	RN	X			X	X
*Blue Jay Area	RN	X				
*Buzzard Swamp Area	RN	X				
*Francis Estate (Clarion River)	RN			X	X	X
*Arroyo (Clarion River)	RN	X				X
*Clark Run (Allegheny River)	RN			X	X	
Arroyo Boat Launch (Clarion River) ¹	RN			X	X	
Barnes Boat Launch (Tionesta Creek) ¹	RN	X		X	X	X
Marienville VIS	R					X
Glasner Run (Tionesta Reservoir)	R			P		
Hopkins Farm (Allegheny River)	R			P	P	P
Motel/Restaurant Complex (Allegheny Reservoir)	R			P	P	
<u>New Resort Construction</u>						
Sugar Bay	R			P		
Kiasutha	R			P		
Hodge Run	R					P
<u>Maintain Existing Facilities</u>	-	X	X	X	X	X

*Indicates small-scale facilities. Remainder are considered large-scale.

¹ These include only a boat launch with no additional facilities. Three additional boat launches built as part of a larger facility are listed together.

Small-scale facilities - Developed campgrounds or complexes usually consisting of less than 50 family campsites, sewage systems are vaults or tank & field, and roads and parking areas are gravel surfaced. The complex is a development scale 3, and usually a roaded natural (RN) ROS class.

Large-scale facilities - Developed campgrounds or complexes consisting of more than 50 family campsites, sewage treatment plant, hot shower facilities, and paved roads and parking lots. The complex is a development scale 4 or 5, and usually a rural (R) ROS class.

Resort facilities - Privately financed and operated complexes that may include campgrounds, cabins, motel units, restaurants, marina services, conference center, tennis court, ski slopes, golf courses, stables, swimming pools, and other similar recreation services. It would be a development scale 5 and a rural (R) ROS class.

Table B-57 Private and Other Agency Undiscounted Costs (5 Decades)

:Private/Other	: Alternatives					:Benchmark:
:Agency Activities:	A	B	C	D	E	2
:Rec. Dev. Const. (M\$)	:	:	:	:	:	:
: Decade 1	: 0	: 0	: 819	: 730	: 730	: 819
: Decade 2	: 0	: 0	: 2,728	: 2,728	: 0	: 2,728
: Decade 3	: 0	: 0	: 3,499	: 0	: 5,956	: 3,499
: Decade 4	: 0	: 0	: 3,647	: 0	: 1,282	: 3,647
: Decade 5	: 0	: 0	: 0	: 0	: 244	: 0
:Rec. Site Oper. & Mntce. (M\$)	:	:	:	:	:	:
: Decade 1	: 0	: 0	: 1,025	: 915	: 915	: 1,025
: Decade 2	: 0	: 0	: 8,870	: 8,650	: 1,830	: 8,870
: Decade 3	: 0	: 0	: 21,665	: 13,640	: 16,720	: 21,665
: Decade 4	: 0	: 0	: 36,455	: 13,640	: 34,815	: 36,455
: Decade 5	: 0	: 0	: 45,270	: 13,640	: 38,325	: 45,270
:Fisheries (M\$)	:	:	:	:	:	:
: Decade 1	: 2,968	: 1,522	: 230	: 1,554	: 1,864	: 230
: Decade 2	: 2,169	: 1,437	: 283	: 1,484	: 1,914	: 283
: Decade 3	: 2,185	: 1,287	: 283	: 1,332	: 1,920	: 283
: Decade 4	: 2,255	: 1,130	: 283	: 1,178	: 1,966	: 283
: Decade 5	: 2,219	: 1,040	: 283	: 1,064	: 1,927	: 283
:TOTAL M\$ 50 Years:	: 10,896	: 6,416	: 125,340	: 108,861	: 110,408	: 125,340

The levels of private investments in Alternatives C, D, and E, have the effect of keeping costs to the agency low.

Trade-Offs Between Alternatives

The major effect of providing these developed facilities is significant increases in "Rural" recreation visitor days. One might expect significant increases in discounted benefits, but due to the fact that rural RVD's have the lowest RPA "willingness to pay value", (about 1/2 that of semi-primitive motorized) the effect on discounted benefits is minimal.

Character of Recreation Settings

The distribution or mix of recreation opportunities can be measured by RVD's and acres by ROS class. Table B-58 shows the distribution of outputs by ROS class, and Table B-59 shows the distribution of acres by ROS class. Alternatives A and B tend toward a more balanced yield of RVD's and acres.

Table B-58 M RVD's by ROS Class (5th Decade)

	A	B	C	D	E	BM 2	BM 9
SPNM	216	248	245	605	239	99	0
SPM	9,794	5,319	2,164	4,163	4,692	1,619	14,714
RN	7,789	7,417	9,509	10,997	16,404	17,619	5,837
R	2,910	2,910	11,095	4,847	9,416	11,095	11,095

Table B-59 M Acres by ROS Class

	A	B	C	D	E	BM 2	BM 9
SPNM	10	11	15	29	10	1	0
SPM	296	210	76	131	139	34	438
RN	197	271	412	343	353	469	66
R	1	1	1	1	1	1	1

To help explain the interactions, the summary for Benchmarks 2 and 9 are shown. In Benchmark 2 where all outputs are valued with no constraint on choice of recreation intensities, FORPLAN assigned most acres to Prescription 3, high recreation intensity. The reason is that total PNV's are highest in the timber prescriptions that also yield roaded natural RVD's. Conversely, where only non-market goods are valued (Benchmark 9) the volume of roaded natural RVD's alone in the timber prescriptions is not competitive with the higher valued SPM RVD's in the 6.1 prescription. Therefore, the land allocation shifts to 6.1.

To emphasize dispersed semi-primitive recreation opportunities, constraints were imposed in Alternatives A, D, and E to yield more acres of prescriptions with SPM and SPNM recreation classes. In alternative D, limiting timber prescriptions (3, 2, 1, and 6.2) to a medium intensity of recreation caused a significant increase in the acres assigned to Prescription 6.1 with a high recreation intensity (6.1 high often has a higher PNV than 3 medium). About 80 percent of the acreage shown, was forced into the allocation to emphasize large, contiguous blocks of SPM, but the rest were selected for having a higher PNV.

In Alternatives A and E, the shift of prescriptions from timber to 6.1 was caused by the longer rotation constraints imposed. Here again, PNV's of the 6.1 prescription with high intensity recreation were very competitive with the 3 and 2 prescriptions with long rotations, especially on marginal timber producing analysis areas.

The acreage allocation or prescription assignments do not affect the level of rural RVD's due to the fact that they are produced by developed facilities requiring a very small acreage. Of course, the amount of rural RVD's varies directly with the amount of developed facilities and resorts proposed. The amounts of RN are also affected some by the number of developed sites and campgrounds constructed that have a more rustic character. The allocation of developed recreation was done outside the FORPLAN model.

This interaction of developed recreation in several ROS classes masks some of the effects of the FORPLAN prescription assignments.

Approximately 50 percent of the RN in Alternatives A, B, C, and D result from developed facilities and only 33 percent of E. Alternatives B, C, and D have higher acres of RN than A but equal or lower total RVD's. This is due to the additional developed facilities and the effect of varying prescription intensities. SPNM and SPM outputs are directly affected by the number of acres assigned to prescriptions with those ROS classes. Total PNV's of prescriptions with SPNM output such as 5, 6.2, or 6.5 are positive, but do not compete with prescriptions calling for either a more intensively managed recreation (6.1) or timber production (2, 3, 4) prescriptions. It is probably due to lower yields

caused by the very low density of use per acre required to maintain the SPNM experience.

Therefore, the range of RVD's or acres in SPNM is mainly a result of the objectives of the alternative for designated wilderness constrained in the model. See the next page for discussions on Wilderness. Except in Alternative D where, as a result of public involvement, the acres of management prescription 6.2 was set at 20,000 acres. This is the reason SPNM RVD's in Table B-58 are so much higher for Alternative D than any other of the alternatives. While 6.5 management prescription was available, it was not chosen or constrained.

In summary, the trade-off to produce more balanced distribution of ROS classes was some reduction of acres assigned to timber prescriptions. This had the net effect of lowering PNV in the alternatives.

Another non-priced trade-off in alternatives that increase acres in the semi-primitive classes is decreased motorized access. The shift from prescriptions that harvest timber and require roads, to those prescriptions that emphasize dispersed recreation and wildlife with fewer roads is the cause. The difference between alternatives can be seen in Table B-60, showing the total road construction miles needed in the first 50 years of the alternative.

Conversely, for those desiring solitude the increase in road construction is seen as a loss in opportunity. Alternative B, with the lowest road construction miles in the first 50 years, provides the greatest amount of semi-primitive settings and opportunity for solitude.

Other trade-offs of increased access and timber harvesting not quantified may be increased erosion and sedimentation, reduction of overall visual quality, and a decrease in wildlife species sensitive to intrusion. These should be minimized by application of standards and guidelines.

Table B-60 Road Construction Total 50 Years

	A	B	C	D	E
Miles of Road	514	479	680	553	546

Trade-Offs Between Alternatives

Problem Statement: Which areas on the ANF should be recommended for Wilderness designation?¹

Using the RPA "willingness to pay" value for RVD's and WFUD's and maximizing PNV, the Wilderness management prescriptions are not high enough to be assigned by FORPLAN in any benchmark or plan alternative. Wilderness prescriptions were constrained in each alternative to meet the Pennsylvania Wilderness Act of 1984 and to the RARE II areas in the benchmark.

The Wilderness benchmark (BM5) was run to determine the trade-offs of designating all of the RARE II areas (34,000 acres) to Wilderness. Compared to the Max PNV Benchmark, PNV was reduced \$18 million or 4 percent. Long-term sustained yield dropped 7 percent to 110.4 MMBF/year. The drop in LTSY and timber volume between the Max PNV Benchmark and the Wilderness Benchmark run could be reduced or eliminated with more intensive timber management, but the result would be an even lower PNV for the Wilderness Benchmark run. Value of the timber harvest was reduced 4.5 million dollars in the first decade. Three-hundred seventy-four thousand RVD's were produced from the Wilderness prescription in the first decade; 747,000 were produced in the fifth decade.

Table B-61 shows the number of acres assigned wilderness prescriptions in each alternative.

Table B-61 Acres of Wilderness by Alternative (M acres)

	Alternative					BM
	A	B	C	D	E	2
Wilderness Prescription-5.5:	10	10	10	10	10	0

Section VIII.D., Analysis of Constraints Within Alternatives, contains detailed descriptions of the effects of wilderness designations in each alternative. Table B-62 shows the estimated effects on priced outputs of wilderness designation compared to the incremental FORPLAN run (constraint set 3) which contained no wilderness prescriptions.

¹ This problem statement was developed prior to the Pennsylvania Wilderness Act of 1984, however, the benchmark and trade-off analysis is still valid and was left in the document.

Table B-62 Effects on Priced Outputs of Wilderness Designations
When Compared With FORPLAN Run With Constraint Set #3

:Parameter	: Alternative					: BM 2 :
	: A	: B	: C	: D	: E	
:Change in PNV (MM\$)	:\$- 5(1%)	:\$-8(2%)	:\$-16(5%)	:\$-6(2%)	:\$-6(2%)	: 0 :
:Change in B/C	:-0.2(3%)	:+.5(6%)	:+ .5(6%)	:-.1(1%)	: 0(0%)	: 0 :
:Change in Timber Harvest : in Decade 1 (MMBF)	: 0 (0%)	:-33(12%)	:-56(11%)	:-11(2%)	:-17(6%)	: 0 :
:Change in LTSY (MBF)	: 0	:- 7(12%)	:- 8(8%)	:- 1(1%)	:-4(5%)	: 0 :

Table B-63 Cost of Wilderness Mineral Acquisition by
Alternative

:	: Alternative					: BM :
	: A	: B	: C	: D	: E	
:Cost of Wilderness : Mineral Acquisition: : (\$MM)	:\$1.8	\$1.8	\$1.8	\$1.8	\$1.8	: 0 :

Table B-63 above displays the estimated cost of acquiring wilderness subsurface rights in each alternative. Acquisition is to occur in the first decade of each alternative.

In general, the discounted financial effects and the effects on priced outputs are relatively low. Congress has passed legislation to establish the Hickory Creek and Allegheny Islands Wilderness Areas and also directed that evaluation of other areas for Wilderness in this cycle of planning is not necessary. As a result of this legislation, Wilderness requirements are the same in all alternatives and the data shown in Tables B-61 and B-63 does not change between alternatives.

Non-priced trade-offs for designating wilderness include:

- Option Values
 - Value which people would place on designation to preserve the option of visiting it in the future.

- Existence Values - Value of designating a wilderness for those who just want to know it exists.
- Scientific Research Values - Value of baseline communities.
- Education Values - Value of tours and ecological study.

The following tables display key activities and their costs, and resource outputs and their values which show the response to problems. The tables are organized by elements which roughly correspond to the problem statements.

Tables include:

B-64 - Key Activities and Outputs by Alternatives

B-65 - Undiscounted Benefits by Alternative

B-66 - Undiscounted Costs by Alternative (Budget)

B-67 - Discounted Economic Indicators by Alternative

The tables not only display the activities and outputs that would be planned for implementation in Decade 1 but a projection of the activities and outputs for future decades. The projections for future decades were necessary to assess long term effects should an alternative and its objectives be continued beyond the first decade. However, any forest plan selected now will be completely revised every 10 to 15 years.

Table B-64 Key Activities and Outputs by Alternative

Activity/Output	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Recreation Element					
Trail Construction (miles)					
Decade 1	81	2	0	45	70
Decade 2	80	2	0	41	69
Decade 3	80	2	0	41	69
Decade 4	80	2	0	41	69
Decade 5	0	0	0	0	0
Decade 10	0	0	0	0	0
Decade 15	0	0	0	0	0
Outputs (M RVD's)					
W03 Semi-primitive, non-motorized					
Decade 1	11	19	41	193	16
Decade 2	12	26	41	258	20
Decade 3	23	49	83	480	37
Decade 4	22	56	83	536	40
Decade 5	13	44	41	399	27
Decade 10	13	44	41	399	27
Decade 15	14	60	83	565	41
W05 Semi-primitive, motorized					
Decade 1	9000	5254	2038	4051	4350
Decade 2	9230	5304	2145	4099	4440
Decade 3	9449	5304	2145	4144	4539
Decade 4	9677	5319	2164	4196	4643
Decade 5	9784	5319	2164	4163	4692
Decade 10	9794	5319	2164	4163	4692
Decade 15	9794	5319	2164	4163	4692
W07 Roaded natural					
Decade 1	5345	7539	8674	9289	12347
Decade 2	5951	7483	8990	9958	13638
Decade 3	6600	7417	9024	10415	14739
Decade 4	7425	7417	9389	10733	15814
Decade 5	7789	7417	9509	10997	16404
Decade 10	7955	7370	9464	10968	16364
Decade 15	7995	7370	9464	10968	16364
W09 Rural					
Decade 1	2910	2910	4353	4193	4095
Decade 2	2910	2910	6764	4321	4095
Decade 3	2910	2910	8099	4496	7865
Decade 4	2910	2910	11095	4847	9371
Decade 5	2910	2910	11095	4847	9416
Decade 10	2910	2910	11095	4847	9416
Decade 15	2910	2910	11095	4847	9416

Trade-Offs Between Alternatives

Table B-64 (con't) Key Activities and Outputs by Alternative

Activity/Output	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Wilderness Element					
Outputs (M RVD's)					
Semi-primitive, non-motorized					
Decade 1	101	102	102	103	106
Decade 2	157	157	157	159	164
Decade 3	175	176	176	178	183
Decade 4	193	195	194	196	203
Decade 5	203	204	204	206	212
Decade 10	203	204	204	206	212
Decade 15	203	204	204	206	212
Wildlife Element					
Activities					
Wildlife Hab. Imp. & Mtce.					
Non-Structural (acres)					
Decade 1	35319	19768	17380	23720	31296
Decade 2	39716	19322	17374	27580	41280
Decade 3	48941	20022	17376	35072	43653
Decade 4	49377	20255	17383	36096	44376
Decade 5	51863	20254	17383	36701	44842
Decade 10	49759	20254	17397	36486	46476
Decade 15	51875	19921	17368	36405	44427
Structural (structures)					
Decade 1	132	4	0	59	118
Decade 2	95	3	0	102	133
Decade 3	81	3	0	140	38
Decade 4	81	3	0	34	37
Decade 5	0	0	0	6	0
Decade 10	0	0	0	0	0
Decade 15	0	0	0	0	0
Treatment Types					
Final Harvest (M Acres) ¹					
Decade 1	0	3	2	3	3
Decade 2	0	3	2	3	3
Decade 3	0	3	2	3	3
Decade 4	0	3	2	3	3
Decade 5	0	3	2	3	3
Decade 10	0	3	2	3	3
Decade 15	0	3	2	3	3

¹ 10% of this acreage receives a clearcut and 90% receives shelterwood seed and removal cuts.

Table B-64 (con't) Key Activities and Outputs by Alternative

Activity/Output	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Thinning (M Acres)					
Decade 1	0	6	3	7	8
Decade 2	0	6	3	7	8
Decade 3	0	6	3	7	8
Decade 4	0	6	3	7	8
Decade 5	0	6	3	7	8
Decade 10	0	6	3	7	8
Decade 15	0	6	3	7	8
Selection (M Acres)					
Decade 1	13	0	0	0	0
Decade 2	13	0	0	0	0
Decade 3	13	0	0	0	0
Decade 4	13	0	0	0	0
Decade 5	13	0	0	0	0
Decade 10	13	0	0	0	0
Decade 15	13	0	0	0	0
Herbicide (M Acres)					
Decade 1	7	0	1	2	2
Decade 2	7	0	1	2	2
Decade 3	7	0	1	2	2
Decade 4	7	0	1	2	2
Decade 5	7	0	1	2	2
Decade 10	7	0	1	2	2
Decade 15	7	0	1	2	2
Hardwood Sawtimber (MMBF)					
Decade 1	40	34	17	36	39
Decade 2	40	34	17	36	39
Decade 3	40	34	17	36	39
Decade 4	40	34	17	36	39
Decade 5	40	34	17	36	39
Decade 10	40	34	17	36	39
Decade 15	40	34	17	36	39
Hardwood Pulpwood (MMBF)					
Decade 1	37	22	10	23	25
Decade 2	37	22	10	23	25
Decade 3	37	22	10	23	25
Decade 4	37	22	10	23	25
Decade 5	37	22	10	23	25
Decade 10	37	22	10	23	25
Decade 15	37	22	10	23	25

Trade-Offs Between Alternatives

Table B-64 (con't) Key Activities and Outputs by Alternative

Activity/Output	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Total Timber (MMBF)					
Decade 1	77	56	27	59	64
Decade 2	77	56	27	59	64
Decade 3	77	56	27	59	64
Decade 4	77	56	27	59	64
Decade 5	77	56	27	59	64
Decade 10	77	56	27	59	64
Decade 15	77	56	27	59	64
Road Constr. (miles)					
Decade 1	30	19	8	15	15
Decade 2	28	11	5	8	17
Decade 3	5	11	9	2	2
Decade 4	4	11	5	4	2
Decade 5	4	9	4	4	1
Decade 10	0	0	1	0	1
Decade 15	0	0	0	0	0
Road Reconstr. (miles)					
Decade 1	6	4	2	6	4
Decade 2	6	2	1	3	5
Decade 3	1	2	2	1	0
Decade 4	1	2	1	2	1
Decade 5	1	2	1	2	0
Decade 10	0	0	0	0	0
Decade 15	0	0	0	0	0
Outputs					
Big-Game (WFUD's)					
Decade 1	632	417	151	293	350
Decade 2	757	422	151	383	491
Decade 3	872	429	151	526	603
Decade 4	963	433	151	624	648
Decade 5	1013	435	151	650	674
Decade 10	1013	435	151	653	675
Decade 15	1013	435	151	653	675
Small-Game (M WFUD's)					
Decade 1	293	270	231	272	263
Decade 2	318	276	220	287	279
Decade 3	341	281	211	301	298
Decade 4	366	292	206	315	313
Decade 5	386	312	210	330	325
Decade 10	490	414	232	404	389
Decade 15	575	500	251	464	447

Trade-Offs Between Alternatives

Table B-64 (con't) Key Activities and Outputs by Alternative

Activity/Output	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Non-Game (M WFUD's)					
Decade 1	626	398	329	443	559
Decade 2	659	395	326	461	609
Decade 3	692	393	324	487	660
Decade 4	729	394	325	509	714
Decade 5	746	393	323	511	740
Decade 10	746	393	323	511	740
Decade 15	746	393	323	511	740
Fish (WFUD's)					
Decade 1	1830	1427	1270	1507	1544
Decade 2	2492	1555	1725	1720	2130
Decade 3	3074	1683	2090	1913	2631
Decade 4	3498	1821	2285	2116	2968
Decade 5	3761	1949	2320	2309	3148
Decade 10	3761	1949	2320	2309	3148
Decade 15	3761	1949	2320	2309	3148
Timber Element					
Activities					
Treatment Types					
Final Harvest (M Acres) ¹					
Decade 1	3	28	66	30	4
Decade 2	3	26	53	31	1
Decade 3	2	20	40	44	5
Decade 4	5	22	42	28	9
Decade 5	5	21	35	37	11
Decade 10	13	25	38	38	17
Decade 15	4	24	37	40	9
Thinning (M Acres)					
Decade 1	11	5	3	87	35
Decade 2	20	13	0	71	92
Decade 3	8	10	37	18	33
Decade 4	20	15	4	70	79
Decade 5	1	12	56	19	6
Decade 10	6	11	7	42	12
Decade 15	12	0	7	1	45

¹ 10% of this acreage receives a clearcut and 90% receives shelterwood seed and removal cuts.

Table B-64 (con't) Key Activities and Outputs by Alternative

Activity/Output	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Selection (M Acres)					
Decade 1	54	18	2	7	107
Decade 2	51	0	0	0	67
Decade 3	54	18	6	7	108
Decade 4	51	0	5	0	67
Decade 5	54	18	6	7	108
Decade 10	51	0	5	0	67
Decade 15	54	18	6	7	108
Herbicide (M Acres)					
Decade 1	24	0	27	18	46
Decade 2	22	0	27	16	29
Decade 3	6	0	22	26	11
Decade 4	6	0	23	14	10
Decade 5	7	0	18	20	15
Decade 10	7	0	20	21	12
Decade 15	7	0	20	22	14
Road Constr. (miles)					
Decade 1	182	124	167	224	203
Decade 2	176	77	101	128	231
Decade 3	33	77	174	36	33
Decade 4	26	77	106	68	37
Decade 5	26	63	98	64	15
Decade 10	14	0	21	0	7
Decade 15	0	0	0	0	0
Road Reconstr. (miles)					
Decade 1	37	29	43	91	54
Decade 2	35	17	27	52	61
Decade 3	6	17	46	15	6
Decade 4	5	17	27	27	7
Decade 5	5	14	23	25	5
Decade 10	3	0	3	0	2
Decade 15	0	0	0	0	0
Outputs					
Hardwood Timber (MMBF)					
Sawtimber					
Decade 1	157	230	519	347	272
Decade 2	125	311	519	426	241
Decade 3	295	326	519	541	543
Decade 4	271	351	519	555	481
Decade 5	290	373	519	617	624
Decade 10	278	272	519	486	426
Decade 15	218	269	519	491	441

Trade-Offs Between Alternatives

Table B-64 (con't) Key Activities and Outputs by Alternative

Activity/Output	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Pulpwood					
Decade 1	255	337	480	539	554
Decade 2	287	356	480	460	585
Decade 3	117	241	480	345	283
Decade 4	141	216	439	331	345
Decade 5	122	194	394	269	202
Decade 10	134	295	379	400	400
Decade 15	168	298	305	395	350
Softwood Timber (MMBF)					
Sawtimber					
Decade 1	0	0	0	0	0
Decade 2	0	0	0	0	0
Decade 3	0	0	0	0	0
Decade 4	0	0	0	0	0
Decade 5	0	0	0	0	0
Decade 10	0	0	90	0	0
Decade 15	10	0	143	0	15
Pulpwood					
Decade 1	0	0	0	0	0
Decade 2	0	0	0	0	0
Decade 3	0	0	0	0	0
Decade 4	0	0	41	0	0
Decade 5	0	0	86	0	0
Decade 10	0	0	11	0	0
Decade 15	16	0	32	0	20
Outputs					
Total Timber Volume (MMBF)					
Decade 1	412	567	999	886	826
Decade 2	412	567	999	886	826
Decade 3	412	567	999	886	826
Decade 4	412	567	999	886	826
Decade 5	412	567	999	886	826
Decade 10	412	567	999	886	826
Decade 15	412	567	999	886	826
Wildlife User Days (M WFUD's)					
Big-Game					
Decade 1	570	868	1311	1178	1065
Decade 2	577	900	1409	1238	1112
Decade 3	511	823	1278	1159	1005
Decade 4	515	777	1163	1120	1010
Decade 5	458	777	1162	1056	923
Decade 10	424	759	1178	1031	815
Decade 15	440	727	1159	1054	859

Trade-Offs Between Alternatives

Table B-64 (con't) Key Activities and Outputs by Alternative

Activity/Output	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Small-Game					
Decade 1	51	187	278	228	84
Decade 2	41	249	387	295	82
Decade 3	43	211	348	257	99
Decade 4	52	196	316	228	131
Decade 5	64	188	311	232	152
Decade 10	91	206	303	236	206
Decade 15	64	219	268	206	180
Minerals Element					
Activities					
Acres Impacted (M Acres)					
Decade 1	59	59	59	59	59
Decade 2	58	58	58	58	58
Decade 3	44	44	44	44	44
Decade 4	27	27	27	27	27
Decade 5	19	19	19	19	19
Decade 10	1	1	1	1	1
Decade 15	1	1	1	1	1
Outputs					
USA Minerals (BBTU)					
Decade 1	170	170	170	170	171
Decade 2	528	528	528	528	530
Decade 3	741	741	742	741	744
Decade 4	715	715	716	715	718
Decade 5	550	551	551	550	553
Decade 10	57	57	57	57	57
Decade 15	54	54	54	54	54
Payments to Counties (M\$)					
Payment in Lieu of Taxes					
Decade 1	1382	1327	509	509	656
Decade 2	1741	927	509	509	1733
Decade 3	509	509	509	509	509
Decade 4	509	509	509	509	509
Decade 5	509	509	509	509	509
Decade 10	1435	771	509	509	509
Decade 15	1718	721	509	509	509

Trade-Offs Between Alternatives

Table B-64 (con't) Key Activities and Outputs by Alternative

: Activity/Output	: Alternative :				
	: A :	: B :	: C :	: D :	: E :
: Units :	: Units :	: Units :	: Units :	: Units :	: Units :
:25% Payment (M\$)	:	:	:	:	:
: Decade 1	: 9747 :	: 9967 :	: 17259 :	: 13968 :	: 12651 :
: Decade 2	: 8313 :	: 11566 :	: 23128 :	: 15504 :	: 8342 :
: Decade 3	: 17145 :	: 16656 :	: 25858 :	: 30338 :	: 27665 :
: Decade 4	: 17471 :	: 19399 :	: 22704 :	: 31854 :	: 21997 :
: Decade 5	: 18058 :	: 21381 :	: 27247 :	: 33450 :	: 29722 :
: Decade 10	: 9537 :	: 12193 :	: 23229 :	: 23827 :	: 18054 :
: Decade 15	: 10403 :	: 12392 :	: 26422 :	: 24608 :	: 16942 :
: Total Payment (M\$)	:	:	:	:	:
: Decade 1	: 11129 :	: 11294 :	: 17768 :	: 14477 :	: 13307 :
: Decade 2	: 10054 :	: 12493 :	: 23637 :	: 16013 :	: 10075 :
: Decade 3	: 17654 :	: 17165 :	: 26367 :	: 30847 :	: 28174 :
: Decade 4	: 17980 :	: 19908 :	: 23213 :	: 32363 :	: 22506 :
: Decade 5	: 18567 :	: 21381 :	: 27756 :	: 33959 :	: 29786 :
: Decade 10	: 10972 :	: 12193 :	: 23738 :	: 24336 :	: 18563 :
: Decade 15	: 11621 :	: 13113 :	: 26931 :	: 25117 :	: 17451 :
: Returns to Treasury (M\$)	:	:	:	:	:
: Decade 1	: 19650 :	: 21540 :	: 34615 :	: 26543 :	: 24581 :
: Decade 2	: 14075 :	: 28741 :	: 56575 :	: 34510 :	: 8538 :
: Decade 3	: 40073 :	: 43030 :	: 65277 :	: 76047 :	: 68622 :
: Decade 4	: 39998 :	: 52371 :	: 60805 :	: 80966 :	: 49541 :
: Decade 5	: 40652 :	: 58307 :	: 73511 :	: 88256 :	: 75178 :
: Decade 10	: 15241 :	: 31527 :	: 64112 :	: 58957 :	: 45491 :
: Decade 15	: 18140 :	: 32088 :	: 73656 :	: 63076 :	: 39535 :

Trade-Offs Between Alternatives

Table B-65 Undiscounted Benefits by Alternative

Activity/Output Elements	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Recreation (M\$)					
Decade 1	110364	93217	74717	99860	116602
Decade 2	115402	93440	90617	104447	124345
Decade 3	120694	93300	96939	110492	145877
Decade 4	126902	93477	110714	116240	169868
Decade 5	133638	93354	110602	116389	162817
Decade 10	134536	93103	110355	114508	161793
Decade 15	134633	93257	110752	116045	161927
Wilderness (M\$)					
Decade 1	940	946	945	955	985
Decade 2	1453	1641	1461	1476	1522
Decade 3	1624	1633	1633	1649	1701
Decade 4	1795	1805	1805	1823	1881
Decade 5	1881	1891	1891	1910	1970
Decade 10	1881	1891	1891	1910	1970
Decade 15	1881	1891	1891	1910	1970
Wildlife (M\$)					
Decade 1	63816	48133	37691	46623	50454
Decade 2	78541	50357	44599	51470	64554
Decade 3	92004	52744	50539	57463	75699
Decade 4	101505	55526	53626	62706	83130
Decade 5	107591	58095	54371	65691	87187
Decade 10	110288	60742	54949	67706	88875
Decade 15	112503	62970	55449	69284	90399
Timber (M\$)					
Decade 1	40064	59388	103124	82898	70969
Decade 2	34017	67901	131171	91764	54381
Decade 3	68023	85685	138181	147253	129649
Decade 4	69309	75372	122120	152618	107962
Decade 5	71555	103497	140372	157925	137673
Decade 10	37750	67154	124776	119301	90355
Decade 15	40863	67569	136193	122154	86204
OGM (M\$)					
Decade 1	502	559	543	525	442
Decade 2	613	664	626	613	524
Decade 3	503	519	473	471	454
Decade 4	308	310	274	277	273
Decade 5	170	163	138	142	165
Decade 10	35	37	33	32	25
Decade 15	35	37	34	32	26

Trade-Offs Between Alternatives

Table B-65 Undiscounted Benefits by Alternative

Activity/Output	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Support (M\$)					
Decade 1	0	0	0	0	0
Decade 2	0	0	0	0	0
Decade 3	0	0	0	0	0
Decade 4	0	0	0	0	0
Decade 5	0	0	0	0	0
Decade 10	0	0	0	0	0
Decade 15	0	0	0	0	0
TOTALS (M\$)					
Decade 1	215686	202243	221556	230861	239452
Decade 2	281883	213823	268474	249770	316295
Decade 3	282848	233881	287765	317328	353380
Decade 4	287299	226490	288539	333664	363114
Decade 5	314835	257000	307374	342057	389812
Decade 10	224490	222927	124776	303457	343018
Decade 15	289915	225724	136193	309425	340526
TOTAL RECEIPTS (M\$)					
Decade 1	39811	40693	69859	56695	51429
Decade 2	33983	46995	93242	62746	34102
Decade 3	69298	67339	104147	122069	111379
Decade 4	70670	78383	91603	128203	88774
Decade 5	73125	86918	109880	134695	119779
Decade 10	39246	49871	94016	96408	73314
Decade 15	42712	50666	106787	99532	68867

Table B-66 Undiscounted Costs by Alternative (Budgets)

Elements	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Recreation (M\$)					
Decade 1	18281	12524	11905	16775	14195
Decade 2	10878	10560	12471	13033	13822
Decade 3	11911	10548	12405	13072	14162
Decade 4	11619	10541	13779	14789	14705
Decade 5	11840	10544	12707	13511	14177
Decade 10	11682	10535	12698	13430	14109
Decade 15	11688	10535	12704	13436	14115
Wilderness (M\$)					
Decade 1	352	354	354	357	369
Decade 2	367	369	369	373	385
Decade 3	397	400	400	403	416
Decade 4	426	430	429	434	447
Decade 5	455	458	458	463	478
Decade 10	455	458	458	463	478
Decade 15	455	458	458	463	478
Wildlife (M\$)					
Decade 1	6585	1919	1852	3003	4025
Decade 2	9351	1845	1799	4890	7249
Decade 3	11770	1949	1800	8096	9630
Decade 4	13873	2021	1800	10417	10613
Decade 5	14982	2058	1800	11035	11138
Decade 10	14530	2059	1800	10992	10979
Decade 15	15100	2058	1800	10988	10974
Timber (M\$)					
Decade 1	16662	18659	33470	32286	30369
Decade 2	16241	14990	28056	25822	32926
Decade 3	14379	16775	29221	25141	26246
Decade 4	14395	14889	22906	24872	28941
Decade 5	13882	15837	25199	20976	24457
Decade 10	15045	14243	21231	22353	23069
Decade 15	15100	15037	21378	18828	28951
OGM (M\$)					
Decade 1	1133	1148	1136	1138	1135
Decade 2	1106	1120	1108	1112	1108
Decade 3	818	827	819	823	819
Decade 4	491	497	492	496	492
Decade 5	253	255	253	256	253
Decade 10	48	48	48	48	48
Decade 15	46	47	23	47	46

Trade-Offs Between Alternatives

Table B-66 Undiscounted Costs by Alternative (Budgets)

	Alternative				
	A	B	C	D	E
	Units	Units	Units	Units	Units
Support (M\$)					
Decade 1	5225	6624	6306	5325	5630
Decade 2	5225	6404	5865	5322	5409
Decade 3	5216	6393	5852	4873	5288
Decade 4	5207	6383	5837	4860	5275
Decade 5	5200	6373	5825	4850	5264
Decade 10	5207	6595	5824	4850	5265
Decade 15	5217	6602	5828	4856	5269
GA (M\$)					
Decade 1	9648	8452	10792	11188	10866
Decade 2	8634	7418	9934	9858	15571
Decade 3	8898	7748	10099	10220	11029
Decade 4	9202	7300	9049	10615	11490
Decade 5	9322	7460	9248	9963	10874
Decade 10	9393	7082	8622	10167	10520
Decade 15	9406	7251	8649	9481	11368
TOTAL (M\$)					
Decade 1	57886	49680	65752	70072	66589
Decade 2	51802	42707	59602	60410	76470
Decade 3	53389	44641	60596	62628	67590
Decade 4	55213	42063	54292	66483	71963
Decade 5	55934	42986	55490	61054	66641
Decade 10	56360	40804	50681	62303	64468
Decade 15	56437	41779	50681	58099	71201

Table B-67 Discounted Economic Indicators by Alternative

	Alternative				
	A	B	C	D	E
Economic Indicators*	Units	Units	Units	Units	Units
Discounted Benefits (M\$)					
Element					
Recreation	299315	235728	237818	271164	347081
Wilderness	3623	3643	3643	3679	3795
Wildlife	212769	132150	116711	138956	172504
Timber	128833	180613	313387	289668	233988
OGM	1062	1142	1078	1054	934
Support	0	0	0	0	0
TOTAL	645602	553276	672637	704521	758302
Discounted Costs (M\$)					
Element					
Recreation	34588	28273	31506	36683	35739
Wilderness	987	993	993	1003	1035
Wildlife	26176	4916	4590	16596	19337
Timber	39050	41554	72253	67491	72970
OGM	2045	2071	2049	2057	2049
Support	13180	16336	15145	12915	13691
GA	23206	19605	25092	26353	30220
TOTAL	139232	113748	151628	163098	175081
Present Net Value (M\$)	506370	439528	521009	541423	583221
Change PNV from Max PNV with MMR	-112369	-179811	- 98330	- 77916	- 36118
Benefit/Cost Ratio	4.6	4.9	4.4	4.3	4.3

*Discount rate is 4%.

2. Economic Analysis and Comparison of Benchmarks and Alternatives

a. Benchmarks

The economic analysis of benchmarks is found in Table B-68. This table presents for each benchmark the PNV, total discounted costs, total discounted benefits, distribution of discounted costs by element, and contribution of discounted benefits from each element. The "maximum PNV with minimum management requirements" is considered as the ANF's base benchmark run. This run values all market and non-market goods and services. The minimum management requirements are placed on this run to insure all legal requirements are met as well as management requirements as set forth in 36 CFR 219.27. The common and standard constraints discussed earlier are also placed on this run. The reasons for changes in PNV's between this run and each benchmark will be discussed in the narrative which follows.

Table B-68 Economic Analysis of Benchmarks

Benchmarks	PNV	Discounted Cost by Element								Discounted Benefit by Element					
		FV Costs	Bene-Fits	Rec	Wild	Wildf	Tbr	CGM	Support GA	Rec	Wild	Wildf	Tbr	CGM	Support
Min Level (#11)	170	11	181	1	0	1	5	2	3	72	0	104	3	1	0
Non-Market (#9)	571	100	670	33	0	23	13	4	27	425	0	209	35	1	0
NDY X09 (#7)	603	177	780	36	0	22	71	4	43	320	0	124	336	1	0
Market (#6)	550	183	734	32	0	1	86	4	60	237	0	97	399	1	0
Wilderness (#5)	601	189	790	36	4	18	82	4	45	300	13	119	356	1	0
H ₁ CGM (#4)	590	191	781	34	0	14	82	15	46	280	0	112	378	11	0
Herbicide (#3)	612	191	803	36	0	20	85	4	45	313	0	119	370	1	0
Max PNV with MMR's (Base Run - #2)	619	192	811	37	0	19	86	4	46	312	0	118	380	1	0
Max PNV with-out MMR (1)	639	196	835	36	0	21	88	4	46	305	0	120	410	1	0
Timber Roll-over (10)	586	213	800	37	0	18	106	4	48	305	0	114	379	1	0

Min-level Benchmark (Run #11)

The minimum level management benchmark run is required by the regulations [36 CFR 219.12(e)(1)(i)]. This represents the minimum level of management which would be needed to maintain and protect the ANF as part of the National Forest System. All acres were constrained to receive management prescription 9.1. The PNV of the "max PNV with MMR's" is \$619 million; the min level benchmark run PNV is \$170 million, a decrease of \$449 million or 73 percent. The discounted costs of all elements are very low. Because of needed OGM administration, the OGM element declines the least, 50 percent. The benefits derived from the benchmark can be considered as induced benefits which are received simply by maintaining the Forest as part of the National Forest System. The discounted benefits drop in all elements. The least affected is the wildlife element where discounted benefits are reduced by only 12 percent. The small reduction in the wildlife element relative to the other elements indicate the benefits in this element are not as sensitive to the Forest's management practices as are benefits in other elements.

Non-market Benchmark (Run #9)

The non-market benchmark run valued only RVD's and WFUD's in the objective function. The PNV of this run was \$571 million. This represents a \$48 million or 8 percent decrease over the base run. The decrease is a result of a 91 percent reduction in the discounted benefits of the timber element. Timber element discounted costs were reduced by 85 percent. The decrease in the timber element costs and benefits was directly related to a shift in management prescriptions allocated. As a result of not valuing market outputs in the objective function 403,000 acres shifted from timber harvesting management prescriptions 2, 3, and 4 to the management prescription emphasizing recreation and wildlife 6.1. The only acres not shifted were 65,720 acres in management prescription 3 allocated to an OGM sub-goal.

The emphasis on non-market outputs and the resultant shift from the timber harvesting prescriptions to management prescription 6.1 also had significant effects on the recreation and wildlife elements. The discounted benefits in the recreation element increased by 36 percent. Discounted costs actually decreased in the

element by 11 percent. This indicates that by allocating management prescription 6.1 the value of RVD's can be increased significantly, while at the same time reducing discounted costs in the recreation element. The increases in net values were a result of both increases in the quantity of RVD's produced and an increase in higher valued RVD's. The shift in management prescriptions also shifted the RVD's produced from roaded natural to semi-primitive motorized.

The benefits and costs associated with the wildlife element were also significantly affected. Discounted benefits rose by 77 percent and discounted costs increased 21 percent. Unlike the recreation element, the wildlife element could increase WFUD production but only by increasing costs. However, the increase in benefits more than offset the increase in discounted costs.

In conclusion, maximizing PNW, while valuing only RVD's and WFUD's, decreases total PNW by 8 percent. Management prescription 6.1 has the highest PNW when considering only recreation and wildlife value. The increase in net benefits associated with the recreation and wildlife elements did not offset the loss incurred in the timber element.

Non-declining yield on Hardwood Sawtimber Benchmark (Run #7)

This benchmark run values both market and non-market outputs but requires non-declining yield on hardwood sawtimber. The PNW of this run is \$603 million, a decrease of \$16 million or 2 percent over the base run. This is not a large change in total PNW when compared to the previous benchmarks. However, examining individual elements indicate that some significant shifts occur in terms of where the contribution to total PNW came from.

Discounted benefits and discounted costs both decline in the timber element. Discounted benefits decrease by \$44 million or approximately 12 percent. Discounted costs are reduced by \$15 million, a 17 percent decline over the base benchmark run. There is not a significant change in acres allocated to management prescription 3 between the two runs. The major change in allocation occurs between management prescriptions 2 and 4 and 6.1. Management prescriptions 2 and 4 together decrease by 42,500 acres and prescription 6.1 is increased by

41,000 acres. The changes in management prescription 3 occur in the allocation of intensities. Less thinning intensities are being allocated as a result of the NDY of sawtimber requirement. The net effect of the NDY constraint in the timber element is a net decrease in PNV of 10 percent. This is a result of a reduction of 41,000 acres being allocated a timber harvesting prescription and less intensive timber management on those acres allocated to even-aged management.

Overall, the decrease in PNV was 2 percent between this benchmark and the base run. Since the PNV of the timber element declined by 10 percent, the remaining elements must partially offset this loss. The discounted costs and benefits in the wildlife element increase slightly with the net effect being a small increase (3 percent) in the present net value of the element. The recreation element displays a characteristic similar to that seen in the benchmark run valuing only RVD's and WFUD's. That is, the shift from management prescription 2 and 4 to 6.1 caused an increase in both quantity and value of RVD's while actually reducing discounted costs slightly.

In summary, the PNV as a result of requiring NDY yield on sawtimber decreased by 2 percent over the base run. A 10 percent decrease in the net present value of the timber element was partially offset by an increase in the recreation element. Thinnings, selection cuts, and intensive timber management become less desirable when NDY of hardwood sawtimber is required.

Market Benchmark (Run #6)

The "market benchmark" values only those resources having established market values in the objective function. For the ANF, this limits outputs valued to only timber outputs. The PNV of this benchmark declines by \$69 million or 11 percent over the Max PNV with MMR's benchmark run. Because the RVD's and WFUD's are not part of the objective function, the emphasis is placed on the production of timber. The effect on the allocation of management prescriptions is to increase the number of acres receiving timber harvesting practices. Furthermore, the financial analysis (our timber prescription economic analysis, see Section III.B.1.f.) indicates that management prescription 3 has the highest PNV of any management prescription on every analysis area when only timber is valued. This results

in a general shift from all management prescriptions to management prescription 3 in the market benchmark run.

The timber element in this run overall shows a net increase in the present value. The discounted benefits increase by \$19 million. The increase in value results from more acres being allocated to timber harvesting prescriptions. Because of the increased harvesting the LSY increases by 8 MMBF/year. The discounted costs of this element do not change even though more acres are allocated to timber harvesting and the volume harvested increased. The reason for this is management prescription 3 is more efficient in terms of economic criteria than other timber harvesting prescriptions. Therefore, by shifting to prescription 3, more volume can be harvested with no increase in discounted costs.

The increase in PNV of the timber element was more than offset by reductions in net values in the recreation and wildlife elements. The net decrease in value of the recreation element was \$70 million. The large reduction in the recreation element was a result of decreases in total numbers of RVD's and a shift of RVD's from semi-primitive non-motorized to roaded natural ROS class. The quantity reduction was a result of the change in management prescriptions from 6.1 to 3 and the change from allocating low recreation/wildlife intensities. The shift in ROS class was a result of allocating less of 6.1 management prescription. The overall effect was a reduction in both discounted benefits and costs of the recreation element.

The net decrease in the wildlife element was \$3 million. Significant reductions occurred in both benefits and costs. The discounted costs of the wildlife element are reduced to less than \$1 million. This indicates that the benefits which do occur are induced and not a result of increased investment in the wildlife element.

The net result on PNV in the market benchmark is a \$69 million reduction over the base run. Valuing only market outputs favors timber harvesting management prescriptions, especially 3. This results in increased volumes and values in the timber element. This increase is offset by reductions in the net value of the recreation and wildlife element. The reduction occurs because of a shift away from management prescription 6.1

and the allocation of low recreation/wildlife intensities.

Wilderness Benchmark (Run #5)

The wilderness benchmark constrains all RARE II areas (33,972 acres) to management prescription 5. Total PNV decreases by \$18 million or 3 percent from the max PNV with MMR's benchmark run. The constraint requiring 33,972 acres to receive management prescription 5 resulted in 28,000 acres being removed from management prescription 3. The remaining 6,000 acres were made up of management prescription 6.1, 4, and 2.

The redistribution of management prescriptions reduced discounted costs in the recreation, wildlife, and timber elements. Discounted benefits were reduced in both the recreation and timber element. The most significant changes in PNV were in the timber element. The net reduction in this element was \$20 million. Volume was approximately 7 percent lower than in the base run.

The net effect on the recreation and wildlife elements were not as great as in the timber element. The recreation element decreased in net value by \$11 million, and the wildlife element actually increased in net value by \$2 million. These changes exactly offset the net increase of \$9 million that occurs in the wilderness element.

In conclusion, the 3 percent reduction in PNV in the wilderness benchmark results from the removal of 28,000 acres from even-aged management and the reduction in timber value and volume harvested. The recreation element decreases slightly in terms of PNV but is offset by the increase in the wilderness element. The net value of the wildlife element actually increases as a result of this constraint.

High OGM Benchmark (Run #4)

The high OGM benchmark estimates the effects of a higher level of oil and gas development than assumed in the base run. (See Section IV.B.2. for explanation of high OGM demand). The result is a \$29 million decrease in PNV. This constraint increased the number of acres allocated to management prescription 3 by 27,700. The management prescriptions in which acres were reduced were 2, 4, and 6.1.

Even though the number of acres receiving management prescription 3 was increased, the discounted benefits decreased slightly over the max PNV benchmarks with MMR's. This is because the analysis areas allocated to 3 are not as productive in terms of timber value or volume as other areas on the forest. However, if OGM development does occur, they become more attractive financially than more productive analysis areas. The result is more acres allocated to management prescription 3, but a reduction in volume and value. The discounted costs of the timber element is also reduced because of efficiencies gained from managing timber in OGM areas. The end result is a net increase in the present value of the timber element of \$2 million.

The recreation and wildlife elements both show decreases in the discounted costs and benefits as a result of applying the high OGM demand scenario. The net result is a decrease in present value of the recreation and wildlife elements of \$29 million and \$1 million, respectively. This indicates the best returns in these elements occur outside OGM developments. In addition, the recreation element is more sensitive to OGM development than the wildlife element.

Summarizing these results, the net value of the timber element increases with OGM development. However, increases in OGM administration cost and reductions in net values of the recreation and wildlife elements result in the PNV being 5 percent lower than the base run.

Delay Herbicide Benchmark (Run #3)

In this benchmark run, herbicide was not allowed in periods 1 or 2 but was allowed beginning in period 3. The result was a reduction in PNV of \$7 million or 1 percent. This represents the least effected of all benchmarks in terms of PNV. The delaying of herbicide use caused 7,200 acres to shift from management prescriptions 2 and 3 to 6.1.

Herbicides are used to control understory vegetation such as fern and striped maple. The critical assumption made is that these problems occur equally in all analysis areas. Therefore, 50 percent of the most productive sites that are ready for harvest in periods 1 and 2 were shifted to management prescription 6.1 or

else the final harvest was delayed. The result was even though only 7,200 acres were shifted from management prescriptions 2 and 3, the LTSY was reduced by 2 MMBF/year and the net present value of the timber element was reduced by \$9 million.

The recreation element shows a small increase of \$2 million in net value. In the wildlife element, a small increase in discounted benefits is offset by an increase in discounted costs. The increase in the recreation element is a result of the 7,200 acres allocated to management prescription 6.1.

If our assumptions are correct, the net effect on PNV of delaying herbicide use is a one percent reduction in PNV. The reduction is a result of not allowing herbicide application on analysis areas that would otherwise be ready for harvest.

Maximize PNV without MMR's Benchmark (Run #1)

This benchmark identifies the opportunity costs associated with the application of minimum management requirements. The PNV of this run was the highest of any benchmark run, 3 percent above the Max PNV with MMR's run. The major prescription assignment shifts over the base run occur in management prescriptions 2, 3, and 6.1. Management prescription 3 increased by 40,700 acres, while management prescription 2 and 6.1 were decreased by 37,000 acres and 3,700 acres, respectively.

Since most of the MMR's we removed were in the timber element, the timber element showed the largest increase in net value as a result of removing MMR's. Discounted benefits increased by \$30 million or 8 percent while discounted costs only increased \$2 million or approximately 2 percent. The reason for the increase in PNV of the timber element is two-fold. One reason is the shift of 40,700 acres to management prescription 3. The second reason is a shift within management prescription 3 to more intensive timber harvesting intensities. Removing MMR's and the associated shift in prescription and intensity allocation also increased timber harvest volume by 10 percent.

The recreation element showed a slight decrease in net value. Discounted benefits decreased by \$7 million and discounted costs by \$1 million. The net effect being a

\$6 million or 2 percent decrease in net value. The change was a result of removing MMR's making the timber harvesting prescriptions more attractive on those lands which are marginal timber producers when MMR's are imposed.

The wildlife element increased equally by \$2 million in both discounted benefits and costs. Therefore, the net effect of removing MMR's on this element was no change in its present net value.

The result of this run indicates that imposing MMR's decrease PNV by 3 percent. As expected, the opportunity costs of MMR's are greatest in the timber element. The MMR's affect management prescription 3 more than 2; by removing the MMR's, 3 looks more attractive financially. In addition, the MMR's affect timber volume. So by removing this effect, marginal timber land PNV's increase, making even-aged management more attractive than management under a prescription (6.1) which emphasizes recreation and wildlife. All this results in an increase in timber value and volume produced. The recreation element decreases slightly as a result of more emphasis being placed in the timber element. The wildlife element once again shows no significant effect as a result of removing the MMR's.

Timber Rollover Benchmark (Run #10)

The benchmark is a result of two FORPLAN runs. The first maximizes timber production for 50 years. The volumes harvested for the first 5 periods are then constrained in a second run in which PNV is maximized. The result is an allocation that increases timber harvest over the base run by 14 percent, but decreases PNV \$33 million or 5 percent. The emphasis on timber production results in a decrease in the acres allocated management prescriptions 6.1 and 3, and an increase in the acres allocated to management prescriptions 2 and 4. The net effect being an increase in acres allocated to timber harvesting management prescriptions.

The timber element decreases slightly in discounted benefits by \$1 million. The significant change in this element is a \$20 million increase in discounted costs. In order to obtain increased volume, production increases in both acres assigned to timber harvesting prescriptions (primarily 2 and 4) and increases in thinning intensities in management prescription 3

occur. The result is increased volume production, but because management prescriptions 2 and 4, and on certain analysis areas thinning intensities of 3 have lower PNV's than even-aged management without thinnings, the total PNV decreases.

In the recreation element, discounted benefits decrease by \$7 million while discounted costs remain unchanged. This results from a change in the value associated with the RVD's produced. The change in total RVD production is small. The shift is a reduction in semi-primitive motorized ROS class, and an increase in roaded natural RVD's. This results in a reduction of 28,700 acres allocated to management prescription 6.1. Since semi-primitive motorized RVD's are valued higher than roaded natural RVD's the discounted value is lower for the same quantity produced.

The discounted benefits and costs decrease slightly in the wildlife element. Discounted benefits decreased by \$4 million and discounted costs by \$1 million. This is a result of slightly less WFUD's being produced, particularly in the first few periods of the planning horizon. Final harvesting tends to favor WFUD production. Since final harvests are decreased in the first 5 periods over the base run, WFUD production also tends to be reduced.

In conclusion, maximizing timber production decreases PNV. To obtain increased volume, increases in both the allocation of timber harvesting prescriptions and thinning intensities occur. These prescriptions and intensities while increasing volume are not as financially efficient as the prescriptions allocated in the base run. The result is a lower net value in all elements.

Summary

The analysis of PNV's of the benchmark runs indicates, in general, that the timber element is the most sensitive to the constraints added in these runs. The wildlife element seems to be least sensitive to the constraints applied.

The following tables display the key activities (and their costs) and resource outputs (and their values) which responds to our management problems. The tables are organized by elements which roughly correspond to the problem statements.

Tables include:

B-69 - Key Activities and Outputs for Benchmarks

B-70 - Undiscounted Benefits for Benchmarks

B-71 - Undiscounted Costs for Benchmarks

B-72 - Discounted Economic Indicators for Benchmarks

Table B-69 Key Activities/Outputs for Benchmarks

Activity/Output	Benchmarks									
	Max PNW : No MMR	Max PNW : With MMR	Max PNW : Market	Max PNW : Non-Mkt	Timber : Rollover	Minimum : Level	Max PNW : Hrbiod.	Max PNW : Hi CGM	Max PNW : NDY X09	Max PNW : Wildnes
	#1	#2	#6	#9	#10	#11	#3	#4	#7	#5
	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
Recreation D.V.										
Activities										
Trail Const. (miles)										
Decade 1	48	52	0	86	51	0	52	37	53	48
Decade 2	48	52	0	86	51	0	52	37	53	48
Decade 3	48	52	0	86	51	0	52	37	53	48
Decade 4	48	52	0	86	51	0	52	37	53	48
Decade 5	0	0	0	0	0	0	0	0	0	0
Decade 10	0	0	0	0	0	0	0	0	0	0
Decade 15	0	0	0	0	0	0	0	0	0	0
Outputs (MRVD's)										
W03										
Decade 1	50	50	50	50	50	0	56	50	57	50
Decade 2	100	100	100	100	100	0	107	100	108	100
Decade 3	100	100	100	100	100	0	114	100	115	100
Decade 4	100	100	100	100	100	0	115	100	115	100
Decade 5	100	100	100	100	100	0	109	100	108	100
Decade 10	100	100	100	100	100	0	109	100	108	100
Decade 15	100	100	100	100	100	0	105	100	115	100
W05										
Decade 1	1373	1477	622	13404	622	3194	1696	1263	2746	1384
Decade 2	1439	1546	669	13781	630	3194	1770	11326	2847	1450
Decade 3	1458	1567	669	14107	669	3194	1797	1343	2900	1470
Decade 4	1495	1607	688	14451	688	3676	1843	1377	2971	1508
Decade 5	1505	1618	688	14614	688	3676	1856	1385	2998	1518
Decade 10	1505	1618	688	14614	688	3676	1856	1385	2998	1518
Decade 15	1505	1618	688	14614	688	3676	1856	1385	2998	1518
W07										
Decade 1	12098	13109	10544	5003	13754	526	12916	11748	12053	12531
Decade 2	14193	14475	10862	5318	15217	460	14248	12683	13216	13827
Decade 3	15197	15559	10908	5352	16396	394	15300	13337	14159	14842
Decade 4	16532	16974	11268	5717	17906	394	16682	14446	15402	16187
Decade 5	17132	17619	11390	5837	18598	394	17310	14938	15961	16797
Decade 10	17091	117573	11344	5791	18532	348	17264	14805	15915	16751
Decade 15	17091	17573	11344	5791	18552	348	16533	14805	15915	16751

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Trade-Offs Between Alternatives

Table B-69 (con't) Key Activities/Outputs for Benchmarks

Trade-Offs Between Alternatives

Activity/Output	Benchmarks									
	Max PNW No MMR	Max PNW With MMR	Max PNW Market	Max PNW Non-Mkt	Timber Rollover	Minimum Level	Max PNW Hrbiod.	Max PNW Hi CGM	Max PNW NDY X09	Max PNW Wildnes
	#1	#2	#6	#9	#10	#11	#3	#4	#7	#5
	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
WD9										
Decade 1	4354	4354	4354	4354	4354	0	4354	4354	4354	4354
Decade 2	6764	6764	6764	6764	6764	0	6764	6764	6764	6764
Decade 3	8099	8099	8099	8099	8099	0	8099	8099	8099	8099
Decade 4	11095	11095	11095	11095	11095	0	11095	11095	11095	11095
Decade 5	11095	11095	11095	11095	11095	0	11095	11095	11095	11095
Decade 10	11095	11095	11095	11095	11095	0	11095	11095	11095	11095
Decade 15	11095	11095	11095	11095	11095	0	11095	11095	11095	11095
Wilderness D.V.										
Outputs										
Disp. Rec. (M RWD's)										
Decade 1	0	0	0	0	0	0	0	0	0	374
Decade 2	0	0	0	0	0	0	0	0	0	578
Decade 3	0	0	0	0	0	0	0	0	0	645
Decade 4	0	0	0	0	0	0	0	0	0	713
Decade 5	0	0	0	0	0	0	0	0	0	747
Decade 10	0	0	0	0	0	0	0	0	0	747
Decade 15	0	0	0	0	0	0	0	0	0	747
Wildlife D.V.										
Activities										
Wildlife Hab. Imp.										
Non-Structural (acres)										
Decade 1	10344	9447	1	9739	8779	0	9487	6749	10361	8643
Decade 2	25855	23433	12	16162	22322	0	23412	16740	24930	21454
Decade 3	26354	24903	30	22585	22362	0	24037	17100	26020	21857
Decade 4	26726	24329	31	29009	22361	0	24571	17419	27058	22238
Decade 5	26727	24330	31	29009	22361	0	24594	17419	27083	22239
Decade 10	26727	24330	31	29009	22361	0	24580	17419	27068	22239
Decade 15	26727	24330	31	29009	22361	0	24580	17419	27068	22239
Structural (structures)										
Decade 1	193	176	0	183	163	0	177	126	193	161
Decade 2	289	260	0	120	252	0	259	186	271	238
Decade 3	99	9	0	120	1	0	12	7	20	8
Decade 4	7	8	0	120	0	0	10	6	19	7
Decade 5	0	0	0	0	0	0	0	0	0	0
Decade 10	0	0	0	0	0	0	0	0	0	0
Decade 15	0	0	0	0	0	0	0	0	0	0

Table B-69 (con't) Key Activities/Outputs for Benchmarks

Activity/Output	Benchmarks									
	Max PNW : No MMR	Max PNW : With MMR	Max PNW : Market	Max PNW : Non-Mkt	Timber : Rollover	Minimum : Level	Max PNW : Hrbiod.	Max PNW : Hr CGM	Max PNW : NDY X09	Max PNW : Wildnes
	#1	#2	#6	#9	#10	#11	#3	#4	#7	#5
	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
Outputs										
Wildlife-Fish (M WFUD's)										
Decade 1	1985	1982	1839	3551	1927	2299	1667	1943	2061	2026
Decade 2	2686	2659	2280	4450	2593	2215	2671	2552	2752	2683
Decade 3	3203	3159	2633	5185	3085	2203	3172	3011	3264	3171
Decade 4	3401	3358	2824	5792	3275	2198	3373	3207	3474	3368
Decade 5	3444	3401	2863	6154	3314	2202	3418	3249	3523	3411
Decade 10	3466	3423	2885	6258	3336	2224	3440	3271	3545	3433
Decade 15	3485	3442	2904	6343	3355	2243	3460	3290	3564	3452
Timber D.V.										
Activities										
Treatment Types										
Final Harvest (M acres) ¹										
Decade 1	27	26	34	5	22	0	18	27	59	23
Decade 2	64	54	63	4	56	0	59	54	56	49
Decade 3	47	35	61	4	28	0	32	38	46	32
Decade 4	68	54	59	4	54	0	57	52	38	50
Decade 5	63	50	63	4	44	0	46	54	37	47
Decade 10	31	43	62	3	21	0	44	39	36	39
Decade 15	44	36	39	4	42	0	35	41	42	36
Thinnings (M acres)										
Decade 1	142	106	145	0	174	1	120	111	3	103
Decade 2	0	0	0	0	44	0	1	0	0	0
Decade 3	99	84	68	0	152	0	84	79	14	81
Decade 4	0	0	0	0	64	0	0	0	1	0
Decade 5	3	1	7	0	20	0	1	4	21	1
Decade 10	81	48	36	6	79	0	49	42	12	43
Decade 15	52	70	93	0	34	0	32	43	17	26

¹ 10% of this acreage receives a clearcut and 90% receives shelterwood seed and removal cuts.

Table B-69 (con't) Key Activities/Outputs for Benchmarks

Activity/Output	Benchmarks									
	Max PNW : No MMR	Max PNW : With MMR	Max PNW : Market	Max PNW : Non-Mkt	Timber : Rollover	Minimum : Level	Max PNW : Hrbicd.	Max PNW : Ha CGM	Max PNW : NDY X09	Max PNW : Wldres
	#1	#2	#6	#9	#10	#11	#3	#4	#7	#5
	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
Selection (M acres)										
Decade 1	16	40	4	0	53	0	50	26	2	37
Decade 2	9	22	0	0	20	0	6	17	0	24
Decade 3	16	40	4	0	56	0	50	26	2	37
Decade 4	9	22	0	0	22	0	6	17	21	24
Decade 5	16	40	4	0	56	0	50	26	2	37
Decade 10	9	22	0	0	25	0	6	17	27	24
Decade 15	16	40	3	0	58	0	50	26	2	37
Herbicide (M acres)										
Decade 1	21	30	18	3	27	0	0	25	26	27
Decade 2	36	36	29	2	31	0	0	34	28	35
Decade 3	28	22	37	2	19	0	29	24	23	21
Decade 4	38	31	30	2	32	0	45	28	29	29
Decade 5	37	34	37	2	30	0	45	34	19	31
Decade 10	18	25	36	2	13	0	27	22	20	23
Decade 15	24	22	22	2	30	0	14	23	24	22
Outputs										
Hardwood Timber (MMBF)										
Sawtimber										
Decade 1	523	491	474	48	423	1	444	494	566	449
Decade 2	756	678	776	62	673	1	588	649	566	596
Decade 3	805	7715	814	52	806	1	780	717	566	668
Decade 4	893	780	800	58	839	1	857	745	566	729
Decade 5	951	891	902	69	893	1	869	857	566	827
Decade 10	420	510	608	55	336	1	426	423	566	467
Decade 15	632	566	442	61	772	1	550	546	566	537
Pulpwood										
Decade 1	792	700	800	46	939	0	727	662	459	658
Decade 2	559	514	498	32	689	1	583	507	481	511
Decade 3	510	477	460	42	556	1	391	439	463	439
Decade 4	422	410	470	36	485	1	313	409	417	376
Decade 5	362	297	344	25	363	1	296	295	358	275
Decade 10	875	675	618	39	539	1	725	713	444	633
Decade 15	557	507	649	33	419	0	522	511	344	459

Trade-Offs Between Alternatives

Table B-69 (con't) Key Activities/Outputs for Benchmarks

Activity/Output	Benchmarks									
	Max PNW : No MMR	Max PNW : With MMR	Max PNW : Market	Max PNW : Non-Mkt	Timber : Rollover	Minimum : Level	Max PNW : Hrbaod.	Max PNW : Hh CGM	Max PNW : NDY X09	Max PNW : Wildnes
	#1	#2	#6	#9	#10	#11	#3	#4	#7	#5
	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
Softwood Timber (MEF)	:	:	:	:	:	:	:	:	:	:
Sawtimber	:	:	:	:	:	:	:	:	:	:
Decade 1	0	0	0	0	0	0	0	0	0	0
Decade 2	0	0	0	0	0	0	0	0	0	0
Decade 3	0	0	0	0	0	0	0	0	0	0
Decade 4	0	0	0	0	0	0	0	0	0	0
Decade 5	0	0	0	0	0	0	0	0	0	0
Decade 10	10	1	26	0	426	0	18	11	82	1
Decade 15	104	98	117	0	53	0	79	79	89	91
Pulpwood	:	:	:	:	:	:	:	:	:	:
Decade 1	0	0	0	0	0	0	0	0	0	0
Decade 2	0	0	0	0	0	0	0	0	0	0
Decade 3	0	0	0	0	0	0	0	0	0	0
Decade 4	1	2	4	0	38	0	1	2	23	2
Decade 5	2	4	28	0	106	0	6	4	49	5
Decade 10	10	6	22	0	61	0	2	9	10	6
Decade 15	22	21	66	0	118	0	20	20	25	20
Total Timber Volume	:	:	:	:	:	:	:	:	:	:
Decade 1	1315	1192	1274	94	1362	1	1171	1156	1025	1108
Decade 2	1315	1192	1274	94	1362	1	1171	1156	1047	1108
Decade 3	1315	1192	1274	94	1362	1	1171	1156	1029	1108
Decade 4	1315	1192	1274	94	1362	1	1171	1156	1006	1108
Decade 5	1315	1192	1274	94	1362	1	1171	1156	973	1108
Decade 10	1315	1192	1274	94	1362	1	1171	1156	1102	1108
Decade 15	1315	1192	1274	94	1362	1	1171	1156	1024	1108
Wildlife User Day (M WFD)	:	:	:	:	:	:	:	:	:	:
Decade 1	1791	1760	1837	279	1784	51	1737	1813	1630	1663
Decade 2	1967	1942	2003	276	1958	41	1914	1984	1864	1838
Decade 3	1871	1819	1900	264	1876	43	1820	1873	1701	1723
Decade 4	1716	1671	1764	267	1746	52	1658	1731	1540	1586
Decade 5	1653	1609	1669	278	1683	64	1594	1669	1505	1525
Decade 10	1644	1589	1651	305	1569	91	1555	1661	1542	1500
Decade 15	1574	1536	1581	274	1606	64	1520	1595	1460	1452

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Trade-Offs Between Alternatives

Table B-69 (con't) Key Activities/Outputs for Benchmarks

Activity/Output	Benchmarks									
	Max PNW No MMR	Max PNW With MMR	Max PNW Market	Max PNW Non-Mkt	Timber Rollover	Minimum Level	Max PNW Hrbacd.	Max PNW Hh CGM	Max PNW NDY X09	Max PNW Wildnes
	#1	#2	#6	#9	#10	#11	#3	#4	#7	#5
	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
Minerals D.V.										
Activities										
Acres Impacted (acres)										
Decade 1	59034	59034	59034	59034	59034	59034	59029	98004	59034	58717
Decade 2	57829	57829	57829	57829	57829	57829	57824	135659	57829	57521
Decade 3	43837	43837	43837	43837	43837	43837	43834	145277	43837	43608
Decade 4	27398	27398	27398	27398	27398	27398	27395	124427	27398	27257
Decade 5	19101	19101	19101	19101	19101	19101	19109	942191	19101	19001
Decade 10	921	921	921	921	921	921	921	8832	921	917
Decade 15	859	859	859	859	859	859	859	8176	859	855
Outputs										
USA Mineral (M BBTU)										
Decade 1	1	1	1	1	1	1	1	2	1	1
Decade 2	1	1	1	1	1	1	1	5	1	1
Decade 3	1	1	1	1	1	1	1	7	1	1
Decade 4	1	1	1	1	1	1	1	7	1	1
Decade 5	1	1	1	1	1	1	1	6	1	1
Decade 10	1	1	1	1	1	1	1	1	1	1
Decade 15	1	1	1	1	1	1	1	1	1	1

Table B-70 Undiscounted Benefits For Benchmark (M\$)

Activity/Output Elements	Benchmarks									
	Max PNW No MMR	Max PNW With MMR	Max PNW Market	Max PNW Non-Mkt	Timber Rollover	Minimum Level	Max PNW Hrbiod.	Max PNW Hi OGM	Max PNW NDY X09	Max PNW Wildnes
	#1	#2	#6	#9	#10	#11	#3	#4	#7	#5
	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
Recreation										
Decade 1	97821	99712	79186	149097	96535	27723	100438	90690	103989	95864
Decade 2	114595	116946	90566	163488	114079	27369	117552	105551	120592	112702
Decade 3	125934	128744	96510	172441	126186	27014	129280	114975	131815	124104
Decade 4	144394	148385	110296	189238	146136	30763	148796	132911	150820	143344
Decade 5	148102	151604	110588	191037	149512	30763	151900	135277	153662	146364
Decade 10	147854	151355	110340	190789	149264	30515	151651	134560	153413	146117
Decade 15	147857	151358	110342	190789	149264	30515	151707	134562	153475	146119
Wilderness										
Decade 1	0	0	0	0	0	0	0	0	0	3468
Decade 2	0	0	0	0	0	0	0	0	0	5359
Decade 3	0	0	0	0	0	0	0	0	0	5990
Decade 4	0	0	0	0	0	0	0	0	0	6620
Decade 5	0	0	0	0	0	0	0	0	0	6936
Decade 10	0	0	0	0	0	0	0	0	0	6936
Decade 15	0	0	0	0	0	0	0	0	0	6936
Wildlife										
Decade 1	33180	33119	29935	61512	31890	42441	33397	32244	34866	34101
Decade 2	45886	45282	36847	77119	43813	41017	45550	42904	47346	45819
Decade 3	55442	54483	42775	90521	52827	40738	54770	51174	56804	54738
Decade 4	58713	57755	45862	100720	55919	40621	58101	54402	60341	57989
Decade 5	59555	58609	46624	107064	56681	40783	58979	55232	61327	58832
Decade 10	60133	59187	47202	109758	57259	41361	559559	55810	61907	59411
Decade 15	60633	59687	47702	111973	57759	41861	60059	56310	62407	59911
Timber										
Decade 1	105617	104541	101276	12407	90752	1326	100648	104750	97813	97897
Decade 2	153689	137940	147294	12648	136375	1066	140035	139027	127985	129299
Decade 3	213924	190842	226877	11614	182858	1118	199496	197806	142966	181208
Decade 4	232836	202868	208355	118302	202868	1352	169685	195555	141921	188705
Decade 5	254141	251746	248692	18278	236566	1664	241285	235988	142726	232895
Decade 10	91585	109471	178976	12932	107128	2366	112123	99001	140686	108332
Decade 15	148765	125241	120421	14910	196435	1664	118042	120526	156522	120876

Table B-70 (con't) Undiscounted Benefits For Benchmark (M\$)

Activity/Output	Benchmarks									
	Max PNW No MMR	Max PNW With MMR	Max PNW Market	Max PNW Non-Mkt	Timber Rollover	Minimum Level	Max PNW Hrbiod.	Max PNW Hi OGM	Max PNW NDY X09	Max PNW Wildnes
	#1	#2	#6	#9	#10	#11	#3	#4	#7	#5
	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
CGM										
Decade 1	545	538	528	542	508	471	538	5707	543	537
Decade 2	613	607	592	657	570	841	608	6425	615	608
Decade 3	451	449	436	519	427	868	450	4757	456	452
Decade 4	253	252	243	314	239	641	253	2701	258	255
Decade 5	123	123	119	167	120	393	124	1363	128	125
Decade 10	31	37	31	37	29	71	33	312	31	31
Decade 15	29	38	31	37	31	71	33	315	32	32
Support										
Decade 1	0	0	0	0	0	0	0	0	0	0
Decade 2	0	0	0	0	0	0	0	0	0	0
Decade 3	0	0	0	0	0	0	0	0	0	0
Decade 4	0	0	0	0	0	0	0	0	0	0
Decade 5	0	0	0	0	0	0	0	0	0	0
Decade 10	0	0	0	0	0	0	0	0	0	0
Decade 15	0	0	0	0	0	0	0	0	0	0
TOTALS										
Decade 1	237163	237910	210925	223558	219685	71961	235021	233391	237211	231867
Decade 2	314783	300775	275299	253912	294837	70293	303745	293907	296538	293787
Decade 3	395751	374518	366598	275095	362298	69738	383996	368712	332041	366492
Decade 4	436196	409260	364756	308574	405162	73377	376835	385569	353340	396913
Decade 5	461921	462082	406023	316546	442879	73603	452288	427860	357843	445152
Decade 10	299603	320050	336549	313516	313680	74313	323366	298683	356037	320827
Decade 15	357284	336324	278486	317709	403489	74111	329841	311713	372436	333874
TOTAL RECEIPTS										
Decade 1	65558	65162	60179	6859	50806	471	61790	69373	68571	60680
Decade 2	109622	994432	102397	7570	92456	841	97146	100392	96284	68095
Decade 3	172091	150181	184402	6775	104894	868	158802	160237	113989	142684
Decade 4	194724	165732	169257	13479	164061	641	152865	159539	115950	153483
Decade 5	217295	215863	211605	13020	199059	393	205769	200017	117277	198927
Decade 10	54904	74009	142132	9221	72116	71	77408	62282	106266	88590
Decade 15	113757	91096	85275	11274	160724	71	84258	85348	131032	74855

Trade-Offs Between Alternatives

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Table B-71 Undiscounted Costs For Benchmark (M\$)

: Activity/Output : Elements	: Benchmarks									
	: Max PNW : No MMR	: Max PNW : With MMR	: Max PNW : Market	: Max PNW : Non-Mkt	: Timber : Rollover	: Minimum : Level	: Max PNW : Hybrid.	: Max PNW : Hi. CGM	: Max PNW : NDY X09	: Max PNW : Wildnes
	: #1	: #2	: #6	: #9	: #10	: #11	: #3	: #4	: #7	: #5
	: Units	: Units	: Units	: Units	: Units	: Units	: Units	: Units	: Units	: Units
: Recreation	:	:	:	:	:	:	:	:	:	:
: Decade 1	: 13947	: 14039	: 12406	: 12525	: 14181	: 155	: 13992	: 13203	: 13795	: 13810
: Decade 2	: 14307	: 14400	: 12611	: 12761	: 14542	: 125	: 14353	: 13411	: 14155	: 14031
: Decade 3	: 14257	: 14352	: 12544	: 12725	: 14493	: 106	: 14305	: 13352	: 14108	: 14120
: Decade 4	: 15785	: 15882	: 14056	: 14267	: 16022	: 104	: 15834	: 14873	: 15638	: 15648
: Decade 4	: 14671	: 14756	: 12984	: 13196	: 14898	: 103	: 14709	: 13898	: 14511	: 14526
: Decade 10	: 14663	: 14748	: 12976	: 13098	: 14890	: 101	: 14700	: 13885	: 14503	: 14518
: Decade 15	: 14669	: 14754	: 12982	: 13104	: 14896	: 101	: 14706	: 13891	: 14509	: 14524
: Wilderness	:	:	:	:	:	:	:	:	:	:
: Decade 1	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 1340
: Decade 2	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 1335
: Decade 3	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 1465
: Decade 4	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 1574
: Decade 5	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 1680
: Decade 10	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 1680
: Decade 15	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 0	: 1680
: Wildlife	:	:	:	:	:	:	:	:	:	:
: Decade 1	: 2371	: 2216	: 189	: 3901	: 1938	: 13	: 2267	: 1537	: 2662	: 2203
: Decade 2	: 8503	: 7788	: 138	: 7653	: 7188	: 13	: 7829	: 5499	: 8590	: 7299
: Decade 3	: 12560	: 11404	: 145	: 10753	: 10595	: 13	: 11464	: 8090	: 12495	: 10606
: Decade 4	: 12770	: 11619	: 149	: 13843	: 10604	: 13	: 11743	: 8251	: 13005	: 10792
: Decade 5	: 12865	: 11725	: 149	: 15443	: 10604	: 13	: 11884	: 8331	: 13270	: 10889
: Decade 10	: 12865	: 11724	: 149	: 14991	: 10604	: 13	: 11881	: 8331	: 13267	: 10889
: Decade 15	: 12865	: 11724	: 149	: 14991	: 10604	: 13	: 11881	: 8331	: 13267	: 10889
: Timber	:	:	:	:	:	:	:	:	:	:
: Decade 1	: 40844	: 40025	: 39867	: 5423	: 50854	: 2128	: 39920	: 38483	: 30995	: 37793
: Decade 2	: 32295	: 30713	: 30236	: 4897	: 38727	: 2074	: 31151	: 30349	: 29229	: 30055
: Decade 3	: 38163	: 36769	: 37230	: 4909	: 45133	: 2074	: 36062	: 34428	: 28679	: 34792
: Decade 4	: 30546	: 29339	: 28841	: 5098	: 37828	: 2074	: 27630	: 27495	: 24887	: 27797
: Decade 5	: 27077	: 27525	: 27691	: 4902	: 32786	: 2074	: 28080	: 26331	: 22254	: 26103
: Decade 10	: 29110	: 29053	: 30403	: 5094	: 29945	: 2074	: 27915	: 25912	: 25101	: 27133
: Decade 15	: 30094	: 30053	: 33771	: 5126	: 32827	: 2074	: 29877	: 28485	: 22638	: 27864

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Trade-Offs Between Alternatives

Table B-71 (con't) Undiscounted Costs For Benchmark (M\$)

Activity/Output	Benchmarks									
	Max PNW No MMR #1	Max PNW With MMR #2	Max PNW Market #6	Max PNW Non-Mkt #9	Timber Rollover #10	Minimum Level #11	Max PNW Hrbacd. #3	Max PNW Hi CGM #4	Max PNW NDY X09 #7	Max PNW Wildnes #5
	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
CGM										
Decade 1	2277	2344	2344	2344	2344	1001	2344	6624	2344	2342
Decade 2	2222	2289	2289	2289	2289	973	2289	7888	2289	2289
Decade 3	1671	1718	1718	1719	1718	723	1718	7260	1718	1718
Decade 4	1032	1058	1058	1059	1058	438	1058	5546	1058	1059
Decade 5	641	655	655	655	655	226	655	3816	655	655
Decade 10	59	63	63	63	63	40	63	484	63	63
Decade 15	57	61	61	61	61	39	61	462	61	61
Support										
Decade 1	6179	6179	6179	3955	6179	1160	6179	6429	6179	6179
Decade 2	5737	5737	5737	3957	5736	1163	5737	5987	5738	5738
Decade 3	5723	5723	5721	3951	5721	1159	5723	5897	5724	5724
Decade 4	5706	5706	5705	3944	5705	1155	5707	5805	5710	5708
Decade 5	5693	5693	5691	3940	5691	1153	5693	5741	5697	5695
Decade 10	5690	5690	5686	3951	5686	1164	5691	5703	5695	5694
Decade 15	5691	5691	5687	3966	5686	1178	5692	5704	5698	5695
GA										
Decade 1	12467	12313	11892	5770	13967	166	12293	12261	10915	12097
Decade 2	11982	11881	10202	6469	12669	166	11965	11995	11700	11850
Decade 3	13389	12943	11185	9982	13979	166	12815	12770	11918	12659
Decade 3	12509	12805	9962	7833	13175	166	11775	11774	11758	11890
Decade 4	11885	11769	9434	7818	12280	166	11899	11333	10995	11612
Decade 10	11854	11949	9855	7625	11932	166	11749	10591	11433	11696
Decade 15	12041	11834	10518	7636	12174	166	11821	11090	10954	11839
TOTAL										
Decade 1	78085	77116	72877	33918	89463	4623	76995	78537	78890	75764
Decade 2	75046	72808	61213	48026	81151	4514	73324	75129	71701	72617
Decade 3	85763	82909	68543	41039	91639	4241	82087	81797	74642	81084
Decade 4	78348	75689	59771	46044	84392	3950	73747	73744	72056	74468
Decade 5	72832	72123	56604	45954	76914	3735	72920	69450	67382	71160
Decade 10	74241	73227	59132	44822	73120	3558	71999	64906	70062	71673
Decade 15	75417	74117	63108	44884	76248	3571	74038	67963	67127	72552

Table B-72. Discounted Economic Indicators by Benchmark

Activity/Output	Benchmarks									
	Max PNW No MMR	Max PNW With MMR	Max PNW Market	Max PNW Non-Mkt	Timber Rollover	Minimum Level	Max PNW Hrbiod.	Max PNW Hi CGM	Max PNW NDY X09	Max PNW Wildnes
	#1	#2	#6	#9	#10	#11	#3	#4	#7	#5
	Units	Units	Units	Units	Units	Units	Units	Units	Units	Units
Discounted Benefits										
Element										
Recreation	304883	311631	237015	425339	304809	71842	313032	280138	320021	300366
Wilderness	0	0	0	0	0	0	0	0	0	13362
Wildlife	119545	118065	97066	209055	114577	104580	118831	112176	123589	119442
Timber	409755	380350	398533	34829	379164	3463	369888	378000	335623	356209
CGM	1053	1044	1018	1126	985	1434	1045	11068	1057	1045
Support	0	0	0	0	0	0	0	0	0	0
TOTAL	835236	811090	733632	670349	799535	181319	802796	781382	780290	790424
Discounted Costs										
Element										
Recreation	36392	36624	32225	32606	36981	316	36504	34308	36006	35964
Wilderness	0	0	0	0	0	0	0	0	0	0
Wildlife	21316	19472	402	22879	17766	33	19673	13779	21848	18246
Timber	88375	85819	86141	12892	105919	5284	85057	82153	71335	81764
CGM	4149	4629	4269	4269	4269	1807	4269	15031	4269	4269
Support	14820	14820	14818	9983	14817	2929	14820	15267	114824	14823
GA	31318	30747	45472	16939	33299	419	30636	30246	28797	30322
TOTAL	196370	191751	183327	99568	213051	10788	190959	190784	177079	189065
Present Net Value	638866	619339	550305	570781	586484	170531	611837	590598	603211	601359
Change PNW from Max PNW with MMR	19527	N/A	-69034	-48558	-32855	-448808	-7502	-28741	-16128	-17980
Benefit/Cost Ratio	4.3	4.2	4.0	6.7	3.8	16.8	4.2	4.1	4.4	4.2

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b. ALTERNATIVES

Introduction

Table B-73 presents and compares present net value (PNV), discounted costs, and discounted benefits for each alternative. The table is derived from economic analysis of the cost and priced benefits associated with each alternative.

The alternatives are arranged in order of their increasing discounted costs. The costs include both capital investments and operation and maintenance costs. Note that total discounted costs increase among the alternatives from \$114 million for Alternative B to \$175 million for Alternative E (Table B-74). These extremes represent a range of \$61 million. For the same alternatives, total priced benefits increase from \$553 million to \$758 million, or a range of \$205 million. The present net value increases from \$440 million for Alternative B to \$583 million for Alternative E, a change of \$143 million (Table B-75).

Table B-73 Economic Analysis of Alternatives by Increasing Discounted Costs (Millions of Dollars)

: Alternatives	: Net Values :		: Costs :		: Benefits :		: Discounted Cost by Element :					: Discounted Benefit by Element :							
	: Change	: Change	: Change	: Change	: Change	: Change	: Rec	: Wld	: Wldlf	: Thr	: OCM	: GA	: Support	: Rec	: Wld	: Wldlf	: Thr	: OCM	: Support
: Alternative B	440		114		553		28	1	5	42	2	36	236	4	132	181	1	0	
	: +66		: +25		: +93														
: Alternative A	506		139		646		34	1	26	39	2	36	300	4	213	129	1	0	
	: +15		: +13		: +27														
: Alternative C	521		152		673		32	1	4	72	2	40	238	4	117	313	1	0	
	: +20		: +11		: +31														
: Alternative D	541		163		704		37	1	16	67	2	39	271	4	139	290	1	0	
	: +42		: +12		: +54														
: Alternative E	583		175		758		36	1	19	73	2	44	347	4	172	244	1	0	

Discounted costs for the oil, gas, and minerals (OGM) element does not change among alternatives. The reason is that projected OGM development on the Forest was held constant across all alternatives. Support costs and general administration (GA) costs vary slightly between alternatives. The change in discounted costs occurs at a slower rate than in resource elements since a significant portion of these costs are fixed overhead costs.

Table B-74 Forest Alternatives in Order of Increasing Discounted Costs

	<u>MM\$ Costs</u>
1. Alternative B	114
2. Alternative A	139
3. Alternative C	152
4. Alternative D	163
5. Alternative E	175

Table B-75 Forest Alternatives in Order of Decreasing Present Net Value

	<u>MM\$ PNV</u>
1. Alternative E	583
2. Alternative D	541
3. Alternative C	521
4. Alternative A	506
5. Alternative B	440

The following narrative gives an explanation of the variations in PNV, discounted costs, and discounted benefits by alternative.

Alternative B

Alternative B is the alternative with the lowest discounted costs (\$114 million). Alternative B emphasizes continuing current management direction and resource emphasis as it has unfolded on-the-ground over the past ten years. The alternative also results in the lowest PNV value (\$440 million) and the lowest discounted benefits (\$553 million).

Alternative B is at the low end of the range of PNV, discounted costs, and discounted benefits because in

this alternative, there is no increased emphasis in any element. All other alternatives place more emphasis on one or more resource elements than the element currently receives. When the increased emphasis occurs, the PNW of the emphasized element more than offsets the reduction, if any, in PNW associated with other elements in that alternative.

The discounted costs and benefits for the recreation element are lower for this alternative than for any other. Both wildlife and timber rank near the bottom in discounted benefits and costs in this alternative. Only Alternative C is lower in wildlife and Alternative A in timber. However, both of these alternatives exceed Alternative B in the PNW of other elements.

Alternative A

Ranked second lowest in total discounted costs is Alternative A. This alternative emphasizes increases (from current levels) in viewing wildlife, hunting, fishing, dispersed recreation opportunities, and designated Wilderness. The discounted cost of this alternative is \$25 million higher than Alternative B. Discounted benefits and PNW decrease by \$93 million and \$66 million, respectively, over Alternative B.

Alternative A ranks first in the discounted costs and benefits associated with the wildlife element. It is second only to Alternative E in the discounted benefits in the recreation element. Alternative E is higher in the recreation element due to increased emphasis in developed recreation and several resorts around the Allegheny Reservoir. This alternative ranks third in discounted costs in the recreation behind Alternatives D and E. The lower costs results from no off-road vehicle trails being provided in Alternative A.

Alternative A ranks last among all alternatives in discounted costs and benefits in the timber element. In this alternative, the emphasis in timber production was decreased over the current situation. The upper limit of total timber harvest volume was 65,000 MCF per decade or approximately 80 percent of current harvest.

Comparing Alternative A to Alternative B (the previous alternative), it is apparent that the element with a decrease in discounted benefits and costs is the timber element. Discounted benefits in this element decreased

by \$52 million and discounted costs decreased by \$3 million. This is a result of the upper limit constraint of 65,000 MCF of total timber harvest . The decrease is more than offset by increases in the recreation and wildlife elements. In terms of PNV, the recreation element increased by \$58 million, while the absolute increase in wildlife is \$60 million.

Alternative C

Alternative C ranks third lowest in discounted costs. The alternative emphasizes the production of goods and services having established market values. Production increases (from current levels) are planned for timber and fee-producing developed recreation. Discounted benefits increase over Alternative A by \$27 million to \$673 million. PNV goes from \$506 million in Alternative A to \$521 million in Alternative C, an increase of \$15 million.

As a result of the emphasis on outputs with market values, Alternative C ranks first in discounted benefits in the timber element. Discounted costs in the timber element are \$72 million which is only exceeded by the discounted costs in Alternative E (\$73 million). The discounted benefits and costs of the wildlife element in Alternative C are lower than any other alternative. The recreation element has the second lowest discounted costs and benefits. This shows that the increased emphasis in developed recreation and resorts of Alternative C do not offset the effects of decreased emphasis in dispersed recreation.

In comparison to the previous alternative (Alternative A), the increase in the timber element more than offset any reductions that occur in the other elements. The absolute increases in discounted benefits in the timber element is \$184 million. Decreases occur in discounted benefits of \$62 million in the recreation element and \$96 million in the wildlife element. In terms of discounted costs, the recreation element decreases by \$2 million and the timber element increases by \$33 million. Discounted costs decrease by \$22 million in the wildlife element. The increase in both discounted benefits and costs of the timber element is a result of increased emphasis in harvesting over Alternative A.

Alternative D

Alternative D is the alternative displaying the second highest discounted cost, a value of \$163 million. This is an increase of \$11 million over Alternative C. The purpose of Alternative D emphasizes increases in the production of both market and non-market goods and services over current levels. The result is Alternative D ranks second highest in PNV when compared to other alternatives, with a value of \$541 million. Alternative D's PNV is \$20 million higher than Alternative C. Its discounted benefits are \$31 million greater than Alternative C.

With the exception of the timber element, Alternative D discounted benefits and costs increase for every element over Alternative C. Because more emphasis is placed on non-market goods, discounted benefits increase for the recreation and wildlife elements by \$33 million and \$22 million, respectively, over Alternative C. Discounted costs in Alternative D increase by \$5 million in the recreation element and \$12 million in the wildlife element over Alternative C.

The increase in PNV in the recreation and wildlife elements more than offset the \$18 million decrease in PNV of the timber element when compared to Alternative C.

Alternative E

The alternative which has the highest total discounted costs is Alternative E. Discounted costs increased by \$12 million over Alternative D. This alternative also has the highest PNV and the highest discounted benefits. The PNV is \$583 million, an increase of \$42 million over Alternative D. The discounted benefits are \$758 million representing a \$54 million increase. As in Alternative D, Alternative E emphasizes increases in the production of both market and non-market goods and services. However, in Alternative E, the increases are greater than in Alternative D.

The discounted benefits are higher in this alternative than in any other alternative for the recreation element. This increase is due to the increased emphasis in this alternative on both dispersed and developed recreation along. Only Alternative A has higher discounted wildlife costs and benefits.

In comparing Alternative E with the previous alternative (Alternative D) discounted costs increase in all elements, except recreation, which decreases by \$1 million.

Discounted benefits increase for all elements except timber compared to Alternative D. In the timber element, discounted costs for Alternative E increase by \$6 million over Alternative D, while discounted benefits decrease by \$56 million. This increase in costs and decrease in benefits is a result of requiring longer rotations in Alternative E. This net decrease in the timber element of \$62 million is more than the offset by net increases of \$77 million and \$30 million for the recreation and wildlife elements, respectively.

PNV of Max PNV with MMR Benchmark versus Alternatives

This section highlights the specific constraints (not constraint sets) accounting for significant differences in PNV between the max PNV benchmark with MMR's valuing market and non-market outputs and the alternatives. The reader should be cautioned that every constraint set will not be evaluated in this section. A more detailed explanation can be found in Section VIII.D, Analysis of Constraints within Alternatives. This section only serves to identify for the reader those individual constraints having large impacts on PNV. The PNV of the max PNV with MMR's benchmark run was \$619 million.

Alternative A has a PNV of \$506 million. This is a decrease of \$113 million over the base run. This occurs primarily as a result of decreasing the total volume harvested. The upper limit on total volume was 489 MMBF per period. The LTSY went from 119 MMBF/year in the benchmark to 49 MMBF/year in Alternative A. Adding this constraint significantly reduced PNV.

Alternative B has a PNV of \$440 million, a reduction of \$179 million over the max PNV with MMR's benchmark run. In Alternative B, the addition of constraint sets 2, 3, and 5 causes large decreases in PNV. Constraint set 2 requires harvesting within + 10 percent of the RPA timber target and also requires at least 45 percent of total volume to be hardwood sawtimber in every period. Both of these constraints have significant effects on PNV. Requiring RPA timber target to be met causes LTSY to be reduced from 119 MMBF/year to 62 MMBF/year, a reduction of 57 MMBF/year. In the benchmark run where

NDY of hardwood sawtimber was required, PNV dropped \$16 million, indicating not allowing deviation in hardwood sawtimber reduces PNV.

Constraint 3 required only low intensity recreation/wildlife intensities to be allocated in Alternative B. This was the most significant constraint added in constraint set 3. The effect of this constraint set reduced PNV by \$76 million, indicating constraining to low intensity recreation and wildlife reduces PNV significantly.

The PNV in Alternative C is \$521 million or \$98 million less than the benchmark run. This alternative has several constraints which also had significant effects on PNV's of other alternatives. There is a requirement of NDY of hardwood sawtimber placed on this alternative as well as the requirement to select only low recreation/wildlife intensities. The remaining requirements in this alternative were constraints on Buzzard Swamp and on 70 percent of the Allegheny Reservoir Face. These two constraints only affected 6,868 acres or one percent of the ANF. Therefore, the reductions on PNV resulted almost entirely from the NDY constraint and the requirement to select low intensity recreation and wildlife.

The PNV in Alternative D is \$541 million, a decrease of \$78 million from the base run. This alternative originally had NDY on hardwood sawtimber. It is the constraint which affected total PNV of this alternative the most. Removing this constraint in the feasibility constraint set (#5) allowed PNV to increase from the previous constraint set. No individual constraint had a significant effect on the PNV of this alternatives once NDY of hardwood sawtimber was removed.

Alternative E has a PNV of \$583 million. This is the highest PNV of any alternative. It is \$36 million less than the max PNV with MMR's benchmark run. The constraint having the most significant effect on PNV is one requiring final harvest not to occur prior to culmination of mean annual increment of dollars. The effect of this constraint is to increase the minimum age at which stands can be final harvested to approximately 120 years. A significant portion of the ANF is in the 60 to 80 year age class. This constraint postpones harvesting in this age class for 40 to 60 years. The financial analysis indicates maximizing PNV occurs prior

Trade-Offs Between Alternatives

to age 120 years. These facts indicate that total PNV will drop if we increase the beginning age for final harvest.

The three constraints which have the most significant effect on PNV of the alternatives are:

- Requiring NDY of hardwood sawtimber.
- Requiring final harvest not to begin prior to culmination of mean annual increment of dollars.
- Constraining low intensity recreation and wildlife prescriptions to be allocated in large amounts.

Other constraints, such as special area management, constraints on conversion prescription, wilderness constraints, etc., do not seem to have a great effect on PNV, at least at the levels constrained to in these alternatives. The constraints identified as having significant implications are based on the results of the incremental and benchmark analysis. They have not been tested separately but seem to contribute most in significantly reducing PNV.

4. Discuss Factors Responsible for Differences in Resolution of ICO's.

See Section VIII C.1. for a discussion of factors primarily responsible for differences in the resolution of the problem statements.

D. Analysis of Constraints Within Alternatives

Introduction

This section contains the tabular results and discussion of completing the incremental constraint analysis described in Section VIII.A. and B. In summary, FORPLAN constraints were developed to achieve the management objectives and direction for each forest plan alternative. To estimate the effects of addressing the problem statements, the FORPLAN constraints were grouped into sets, with each set addressing one problem statement.

Four constraint sets were used for each alternative to address problems:

<u>Constraint Set #</u>	<u>Problem Statement Addressed</u>
2	Timber
3	Recreation/Wildlife
4	Wilderness/NRA
5	Public Review (Alternative B)
6	Public Review (Alternative D)

Constraint set 1 contained the same constraints used in the Max PNW benchmark to ensure feasibility. Constraint set 1 contains the same constraints in every alternative, and thus always has the same effects. It will not be discussed in this section.

As a result of public comment on the DEIS, constraint set 5 was added to Alternative B and constraint set 6 was added to Alternative D. Constraint set 5 for Alternative B constrains the model to zero acres of herbicides in all periods. The additional constraint set in Alternative D adds several constraints which respond to issues identified by the public.

See Section VII.C.2. for a complete description and rationale for each constraint and constraint set.

This section, then, discusses the effects of adding each constraint set incrementally to FORPLAN.

The changes in activities/outputs and effects, discounted costs, and discounted benefits are shown as each constraint set is added.

The order in which the constraint sets are added is important in interpreting results. We have added the constraints with the greatest probable impact on opportunity costs first.

The following set of tables are provided for each alternative:

Title

- Management Prescription Assignments from FORPLAN for each Alternative by Constraint Set
- Economic Indicator from FORPLAN for each Alternative by Constraint Set
- Economic Indicators from FORPLAN for each Alternative by Constraint Set by Element.
- Key Activity/Output and Budget/Receipt Summary from FORPLAN for each Alternative by Constraint Set

General Effects of Constraints

All constraints which place an upper limit on hardwood timber volume limit the PNV. Thus, raising the upper limits on hardwood volume will raise the PNV in those alternatives where we use the constraint. When the upper limit on timber volume is reached, FORPLAN assigns the next highest PNV prescription, 6.1, because of the high value of WFUD's and RVD's produced in that prescription.

When older rotations are used in Alternatives A and E, substantial acres of prescription 2.2 are assigned. Reasons are two-fold:

- PNV's of the 2 prescriptions become more competitive with 3 because of the delayed regeneration cuts in 3. In 2, harvests can begin in decade 1.
- To maintain a high non-declining yield, the model schedules the regeneration harvests which are available early in 2 until AA's reach age 120 years in prescription 3.

Wilderness constraints do not significantly effect PNV's or harvest flows.

Unless they are not allowed in the solution (constrained out), the high investment recreation and wildlife prescription intensities are nearly always selected. Their high PNV's are caused by the amounts and assigned values of RVD's and WFUD's. Thus, constraints which limit the assignment of high investment intensities, will reduce the PNV.

Non-declining yield on total timber volume is binding on the solution in all benchmarks and alternatives. Allowing timber volumes to fluctuate (increase in some decades, decline in others) would increase PNV's.

ALTERNATIVE A: Alternative A emphasizes the production of goods and services that maximize social, non-consumptive benefits, and the production of high-quality hardwoods. Constraint set 1, as in all alternatives, represents those constraints used in the maximize present net value benchmark run. This represents a base or starting point from which to assess the effects of adding the additional constraint sets which address the problem statements.

Constraint set 2 addresses the timber problem statement. In Alternative A the emphasis is on growing high-quality hardwoods. Timber volume is reduced from current levels. Hardwood sawtimber volume has a lower limit of 100 MMBF for all periods and total timber volume has an upper limit of 412 MMBF for periods 1 to 15. No oak conversion prescriptions were allowed.

The effect on PNV of adding these constraints is a reduction of \$65 million (15%) from the base run. However, the benefit/cost ratio increases from 5.3 in the base run to 7.9 after adding constraint set 2. Table B-78 which shows discounted benefits and costs reveals that total discounted costs were reduced by 47 percent while discounted benefits only dropped 20 percent by adding constraint set 2. Both the recreation and wildlife elements increased in terms of discounted benefits after adding constraint set 2. The discounted benefits from the timber element were reduced by \$219 million after the addition of the timber problem statement. This is not surprising since the timber constraint set constrained the upper limit of timber harvest. In fact, the upper limit of 412 MMBF of total timber volume per period was binding in every period.

Constraints Within Alternatives

Table B-76 displays the management prescription allocation. The major shift between constraint sets 1 and 2 was a shift from management prescription 3 to management prescription 6.1. This represents a shift from even-aged management of timber to a prescription that emphasizes recreation and wildlife with little timber harvest.

In summary, the reduced timber harvest level is responsible for the reduced level of benefits and costs from the timber element and the increased levels in recreation and wildlife. Throughout all alternatives, the activities and outputs associated with timber harvesting are reduced between constraint sets 1 and 2 while recreation and wildlife activities and outputs are increased. The shift from roaded natural RVD's to semi-primitive motorized RVD's is due to the shift from management prescription 3 to 6.1.

Constraint set 3 addresses the recreation and wildlife problem statement. The emphasis in this constraint set is to provide widely scattered, dispersed recreation use and intensive management of game and non-game species which favor a mature northern hardwood timber type. The Allegheny Reservoir Face is constrained to management prescription 6.1 to provide a semi-primitive motorized opportunity around the reservoir. No even-aged management is allowed on steep slopes and bottomlands in order to maintain visual quality, soil, and water objectives. Buzzard Swamp and existing aspen sites are constrained to intensive management for wildlife. The high recreation/wildlife intensity will be assigned to all acres of the forest. Finally, rotation ages will begin at culmination of mean annual increment of value per acre rather than volume to ensure larger trees per acre.

The effect on PNV of all these constraints is a reduction of \$15 million (4%) over constraint set 2. The benefit/cost ratio drops to 7.4 (see Table B-77).

Of all the constraints added, the only ones which are binding are the 11,374 acres required to receive an aspen management prescription and some of the areas along the Reservoir Face constrained to management prescription 6.1. However, the acreage involved is only

4 percent land base. The constraints on even-aged management on steep slopes and bottomlands and zero acres of low and medium recreation/wildlife intensity were not binding. The only other constraint was the harvesting constraint not to final harvest prior to culmination of mean annual increment of dollar value.

This constraint resulted in final harvest ages starting at age 120 instead of age 60. The results of the financial analysis on PNV's of individual prescriptions indicates, in general, the PNV's of timing options harvested at younger ages are greater than PNV's of older age timing options. Thus, increasing the age of regeneration harvests will generally reduce PNV.

Table B-76 reveals that the major shift in management prescription allocation between constraint sets 2 and 3 is an increase of 86,000 acres allocated to uneven-aged management and decrease of 92,000 acres in management prescription 3. This occurs for two reasons: 1) the PNV of management prescription 2 becomes more competitive with 3 as a result of postponing final harvest in 3, and 2) the non-declining yield requires some timber be harvested early - because the final harvest is delayed in 3 this timber is picked up through selection harvest in 2. This is illustrated in Table B-79 where the amount of final harvest and thinning acres are reduced between constraint sets 2 and 3 while the acres of selection harvest is doubled. No significant changes in RVD's and WFUD's occur between constraint sets 2 and 3.

Constraint set 4 requires Hickory Creek and the Allegheny River Islands to be allocated to Wilderness and the NRA's allocated to management prescription 6.1. As a result of the addition of this constraint set, the allocation of acres to management prescription 6.1 decreases by 13,000 acres. Acres in management prescription 2 decreased by 2,000 acres and increased by 4,000 acres in prescription 3. PNV is reduced by one percent from \$364 million in constraint 3 to \$359 million in constraint set 4. Table B-78 indicates that, in terms of discounted benefits and costs, the reduction in PNV is due to the increased costs of wilderness management and the fact that although discounted benefits in wilderness are \$4 million, this does not offset the \$7 million loss of discounted benefits in the recreation element.

Summarizing the effects of the constraint sets in Alternative A, the largest impact occurs as a result of reduction in timber harvest volume in constraint set 2. The effects on discounted benefits and costs of the subsequent addition of constraint sets 3 and 4 are low compared to constraint set 2. It is interesting to note the trend in benefit/cost ratio from constraint set 1 to 4. The ratio goes from 5.3 to 7.9 to 7.4 to 7.2. This is due mainly to the reduction in total discounted costs between the Max PNV benchmark and the constraint set.

Table B-76: Management Prescription Assignments from FORPLAN
For Alternative A by Constraint Set

<u>Management Prescription</u>		<u>Total M Acres Assigned</u>					
		<u>CS1</u>	<u>CS2</u>	<u>CS3</u>	<u>CS4</u>		
		<u>Max</u>	<u>PNV</u>	<u>BM</u>	<u>Timber</u>	<u>Rec/Wldlf</u>	<u>Wilder./NRA</u>
Aspen, Grouse	1	0	0	11	11		
Uneven-aged, Non-game	2	62	21	107	105		
Even-aged, Turkey, Deer	3	388	158	66	70		
Even-aged, Softwood	4	19	0	6	5		
Wilderness	5	0	0	0	9		
Recreation, Wildlife	6.1	29	315	302	289		
Even-aged 10 yr. SPNM 30 yr.	6.2	1	3	2	1		
Wetland Wildlife	6.3	0	0	0	0		
Long Rotation Primitive	6.5	0	0	0	0		
Developed Recreation	7	0	0	0	0		
Special Areas	8	0	0	0	0		
Minimum Level	9.1	6	6	9	12		

Constraints Within Alternatives

TABLE B-77: ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE A
BY CONSTRAINT SET

ECONOMIC INDICATORS*	CONSTRAINT SETS (CS)			
	CS1 Max PNv BM	CS2 Timber	CS3 Rec/Wldlf	CS4 Wilderness/NRA
PRESENT NET VALUE (MM\$)	444	379	364	359
CHANGE PNv FROM MAX PNv WITH MMR	-65	-15	-5	
BENEFIT/COST RATIO	5.3	7.9	7.4	7.2

*Discount rate 4%.

Constraints Within Alternatives

TABLE B-78: ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE A BY ELEMENT

ECONOMIC INDICATORS*	CONSTRAINT SETS (CS)			
	CS1 Max PNV BM	CS2 Timber	CS3 Rec/Wldlf	CS4 Wilderness/NRA
<u>DISCOUNTED BENEFITS (MM\$)</u>				
<u>Element</u>				
Recreation	157	240	248	241
Wilderness	0	0	0	4
Wildlife	22	48	46	45
Timber	359	140	125	126
OGM	1	1	1	1
Support	1	1	1	1
<u>TOTALS</u>	539	429	420	417

DISCOUNTED COSTS (MM\$)

<u>Element</u>				
Recreation	8	5	6	6
Wilderness	0	0	0	1
Wildlife	17	16	13	12
Timber	71	27	34	34
OGM	2	2	2	2
Support	3	3	3	3
<u>TOTALS</u>	101	54	57	58

Discount Rate 4%

Constraints Within Alternatives

**TABLE B-79: KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN
FOR ALTERNATIVE A BY CONSTRAINT SET**

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)								
	CS1		CS2		CS3		CS4		
	Max M Units	PNV M\$	BM M Units	Timber M\$	Rec/Wldlf M Units	M\$	Wilderness/NRA M Units	M\$	
TIMBER									
<u>LTSY (MBF/Year)</u>	119		41		41		41		
<u>Timber Volume (MBF/Decade)</u>									
Hardwood Sawtimber									
Decade 1	492	64320	155	25049	162	26666	157	26020	
2	678	93272	274	38808	126	20134	125	20080	
3	715	149055	288	53201	296	55459	295	55525	
4	780	164470	272	58325	272	57146	271	57092	
5	891	214730	295	68548	290	59718	290	59685	
10	510	72898	211	36757	270	23742	278	25923	
15	566	87097	269	55286	221	30324	218	29168	
Softwood Sawtimber									
Decade 1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	
10	1	19	0	0	0	0	0	0	
15	98	2782	0	0	12	122	10	146	
Hardwood Pulpwood									
Decade 1	700	0	257	0	250	21	255	21	
2	514	0	138	0	286	22	287	21	
3	477	0	124	0	116	0	117	0	
4	410	0	140	0	140	6	141	6	
5	297	0	117	0	122	0	122	0	
10	675	0	201	0	142	19	134	18	
15	507	0	143	0	159	12	168	0	
Softwood Pulpwood									
Decade 1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	2	13	0	0	0	0	0	0	
5	4	29	0	0	0	0	0	0	
10	6	45	0	0	0	0	0	0	
15	21	169	0	0	20	159	16	93	

Constraints Within Alternatives

TABLE B-79: (con't) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE A BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)								
	CS1		CS2		CS3		CS4		
	Max PNV	BM	Timber		Rec/Wldlf		Wilderness/NRA		
	M Units	M\$	M Units	M\$	M Units	M\$	M Units	M\$	
<u>TIMBER (con't)</u>									
Total Timber Volume									
Decade	1	1192	64320	412	25049	412	26687	412	26041
	2	1192	93272	412	38808	412	20156	412	20101
	3	1192	149055	412	53201	412	55459	412	55525
	4	1192	164483	412	58325	412	57152	412	57092
	5	1192	214759	412	68548	412	59718	412	59685
	10	1192	72962	412	36757	412	23761	412	25941
	15	1192	90048	412	55286	412	30617	412	29407
<u>Final Harvest (acres)</u>									
Decade	1	26		7		3		3	
	2	54		21		3		3	
	3	35		8		2		2	
	4	54		21		5		5	
	5	50		14		4		5	
	10	43		16		13		13	
	15	36		14		5		4	
<u>Thinnings (acres)</u>									
Decade	1	106		40		10		11	
	2	0		0		18		20	
	3	84		28		7		8	
	4	0		0		18		20	
	5	1		0		1		1	
	10	48		24		5		6	
	15	40		0		8		12	
<u>Selection (acres)</u>									
Decade	1	40		21		54		54	
	2	22		0		52		51	
	3	40		21		54		54	
	4	21		0		52		51	
	5	40		21		54		54	
	10	21		0		52		51	
	15	40		21		54		54	

Constraints Within Alternatives

TABLE B-79: (con't) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE A BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)							
	CS1		CS2		CS3		CS4	
	Max PNV M Units	BM M\$	Timber M Units	M\$	Rec/Wldlf M Units	M\$	Wilderness/NRA M Units	M\$
<u>TIMBER (con't)</u>								
<u>Herbicide (acres)</u>								
Decade 1	30	1044	13	451	24	833	24	824
2	36	1264	11	382	23	801	22	785
3	22	790	6	230	6	206	6	204
4	31	1057	12	403	6	208	6	207
5	34	1159	9	333	7	241	7	242
10	25	869	8	295	7	239	7	245
15	22	779	10	344	7	248	7	233
<u>RECREATION/WILDLIFE</u>								
<u>SPNM W03 (RVD/Decade)</u>								
Decade 1	0	0	31	284	20	187	121	1039
2	0	0	35	327	23	216	169	1563
3	0	0	66	610	44	404	198	1862
4	0	0	68	634	45	422	215	1991
5	0	0	42	387	28	258	216	2005
10	0	0	42	387	28	258	216	2005
15	0	0	70	646	46	430	227	2102
<u>SPM W05 (RVD/Decade)</u>								
Decade 1	898	6994	9461	73701	9004	70145	8627	67207
2	920	7165	9699	75555	9232	71921	8846	68913
3	942	7336	9937	77409	9460	73697	9065	70619
4	970	7558	10181	79313	9695	75527	9293	72393
5	980	7644	10300	80240	9809	76415	9400	73227
10	980	7644	10300	80240	9809	76415	9400	73227
15	980	7644	10300	80240	9809	76415	9400	73227
<u>RN W07 (RVD/Decade)</u>								
Decade 1	8632	46614	2804	15140	3804	20542	3881	20955
2	9617	51929	3041	16423	4234	22861	4379	23324
3	10601	57245	3279	17706	4663	25180	4758	25693
4	11651	62916	3582	19342	5158	27852	5262	28415
5	12176	65751	3733	20160	5405	29188	5514	29775
10	12130	65502	3688	19913	5360	28941	5468	29528
15	12130	65502	3688	19913	5360	28941	5468	29528

Constraints Within Alternatives

TABLE B-79: (con't) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE A BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)							
	CS1		CS2		CS3		CS4	
	Max PN	BM	Timber		Rec/Wldlf		Wilderness/NRA	
	M Units	M\$	M Units	M\$	M Units	M\$	M Units	M\$
<u>RECREATION/WILDLIFE (con't)</u>								
<u>Big-Game (WFUD/Decade)</u>								
Decade 1	1635	36400	1253	27884	1201	26738	1202	26767
2	1944	43267	1456	32389	1332	29657	1334	29698
3	2007	44680	1562	34760	1382	30762	1383	30799
4	1900	42299	1596	35525	1479	32933	1478	32909
5	1847	41123	1632	36318	1474	32811	1471	32762
10	1835	40853	1610	35850	1441	32079	1437	32002
15	1817	40447	1609	35813	1458	32449	1453	32311

Constraints Within Alternatives

ALTERNATIVE B: This alternative emphasizes continuing current management direction. Constraint set 1 is again the max PNV benchmark. Constraint set 2 addresses the timber problem statement. The constraints in this set attempt to follow the objectives of current timber management on the ANF. Hardwood sawtimber is required to be at least 45 percent of the total harvest. The constraint for timber harvests are based on the RPA targets. A minimum of 2,000 acres of final harvest per year is required. No oak conversions and no conifer management on low stocked areas is permitted.

Of the constraints described, the only one binding is total harvest volume in period 1. This constraint is binding at its upper limit of 660 MMBF of total timber volume harvested in the first period. The shadow price on this constraint is \$480 per MBF. Table B-81 shows a decrease in PNV between constraint sets 1 and 2 of \$44 million. However, benefit/cost ratio increases from 5.3 to 6.8. Table B-82 displays a large decrease in both discounted benefits and costs associated with the timber element between the two constraint sets. The increases in discounted benefits and costs occur in the recreation and wildlife elements. The reason for this is that the RPA timber targets result in about one-half the volume harvested in the benchmark run. As a result of this, Table B-80 shows a shift in management prescription allocation from the timber harvesting prescriptions of 2 and 3 to the prescription that emphasizes recreation and wildlife - 6.1. This reduction in timber and increase in recreation and wildlife explains the variations in activities and outputs that occur between constraint sets 1 and 2 in Table B-83.

Since 19,000 acres of the conifer management prescription (4) was allocated in the benchmark run, the fact that the conifer management prescription was not allowed into solution may also effect the PNV. However, the results of the financial analysis indicates that PNV's in management prescription 3 are higher than management prescription 4 for all analysis areas. Therefore, the reason the 4 management prescription is allocated in the benchmark run is due to the large volume being harvested and the requirement of NDY. The volume in Alternative B is greatly reduced and, as a result, 4 would probably not have come into solution even if it had not been constrained out.

Constraint set 3 describes the current situation as it relates to recreation and wildlife on the ANF. Three intensities of recreation and wildlife were developed with the low intensity representing the current situation. The constraint used was to not allow the medium and high intensities into solution. Other constraints were to constrain the 8,695 acre of the Allegheny Reservoir Face and Buzzard Swamp to minimum level management (9.1). The Reservoir Face was allocated 9.1 to maintain visual quality objectives and recreation potential of the area. Buzzard Swamp was allocated 9.1 with additional costs and outputs being added outside FORPLAN to manage the area under management prescription 6.3

Table B-81 shows a decrease in PNW of \$76 million after adding this set of constraints. The benefit/cost ratio continues to rise going from 6.8 to 7.4. The largest reduction in discounted benefits and costs (Table B-82) occurs in the recreation and wildlife elements. This was expected since medium and high intensity recreation and wildlife were constrained out of solution. Unless a management prescription which has a choice of intensities for recreation and wildlife is constrained otherwise the high intensity is always chosen over the low. Activities and outputs (Table B-83) associated with the timber element change very little between constraint sets 2 and 3. The RVD's and WFUD's are reduced in all ROS classes due to constraining medium and high intensity recreation and wildlife out of solution.

Table B-80 indicates no major changes in management prescription allocation between constraint sets 2 and 3. The only reduction was a loss of 18,000 acres in management prescription 6.1. These acres were redistributed over four management prescriptions.

Management prescription 9.1 was allocated an additional 9,000 acres, management prescription 3 and 1 received 4,000 additional acres each, and the uneven-aged prescription of 2 received 1,000 more acres when constraint 3 was added to Alternative B. The 9,000 acre increase in 9.1 is the result of constraining the Reservoir Face to 9.1. The increase in 1 from 0 to 4,000 acres is due to management prescription 1 having a higher PNW on some areas than low intensity 6.1. In

addition, 1 adds some timber volume into solution. The increase in management prescriptions 2 and 3 was a result of the acres in Buzzard Swamp and the Reservoir Face which were formerly allocated 3 and/or 2 being forced to 9.1. As a result, less productive areas were brought into solution requiring more acres to be harvested and resulting in an increased allocation to management prescriptions 2 and 3.

Constraint set 4 constrains Hickory Creek and the Allegheny River Islands to Wilderness (management prescription 5) and the Allegheny NRA to management prescription 6.1. Table B-80 indicates that adding constraint set 4 causes a reduction in PNV of \$8 million. The benefit/cost ratio continues to increase from 7.4 to 7.9 after constraint set 4 is added. Table B-79 shows a 9,000 acre increase in 5, 16,000 acre increase in 6.1, and 3,000 acres increase in 9.1. The increase is offset by decreases in management prescriptions 2 and 3. The decrease in management prescriptions that harvest timber resulted in a drop in LTSY from 67 MMBF/year to 60 MMBF/year. The amount of timber harvested in period 1 is no longer at its limit. As a result of the decrease in timber harvested, other activities and outputs associated with the timber element (Table B-83) dropped slightly. There was an increase in semi-primitive non-motorized and motorized RVD's and a decrease in roaded natural RVD's. This was a direct result of the change in management prescription allocation.

Constraint set 5 constrains acres of herbicide use to zero. The effect of this constraint on the allocation was an increase of 4,000 acres allocated to timber management prescriptions from management prescription 6.1. There was a \$20 million decrease in PNV. The benefit/cost ratio remained at 7.9. Table B-82 indicates a 12 percent (\$20 million) decrease in discounted benefits in the timber element. The discounted costs in the timber element decrease by \$3 million or 8 percent. Discounted benefits and costs in other elements vary only slightly or not at all. Even though more acres were allocated to management prescriptions that harvest timber, LTSY decreases by 3 MMBF/year to 57 MMBF/year after adding constraint set 5. Hardwood sawtimber volumes in constraint set 5, except in decade 2, are less than in constraint set 4

(Table B-83). In decade 1, hardwood sawtimber production decreased by 15 percent. The most significant change is acres of herbicide in period decade 1, going from 23,000 acres at a cost of \$789,000 to zero acres at a cost of \$0. There are only slight variations in RVD's and WFUD's between constraint sets 4 and 5.

In summarizing the effects on Alternative B of the addition of the constraint sets, it is obvious both constraint sets 2, 3, and 5 were very influential in the alternative. The addition of constraint set 2 had the largest effects in terms of prescription allocation and activities and outputs. Constraint set 3 caused the largest drop in PNV. Constraint set 5 did not have a large effect on the allocation but did reduce PNV by \$20 million and also reduced the acres of herbicide application to zero.

The effects of the addition of Wilderness (constraint set 4) did not have a significant influence on the Alternative. Of interest, the benefit/cost ratio increased or remained the same as constraint sets were added. The reason was because the percent reduction in discounted cost as constraint sets were added was greater than the percent reduction in discounted benefits.

TABLE B-80: MANAGEMENT PRESCRIPTION ASSIGNMENTS FROM FORPLAN
FOR ALTERNATIVE B BY CONSTRAINT SET

Management Prescription		Total M Acres Assigned				
		CS1	CS2	CS3	CS4	CS5
		Max PNV	BM	Timber	Rec/Wldlf	Wilder/NRA
Aspen, Grouse	1	0	0	4	4	2
Uneven-aged, Non-game	2	62	16	17	15	20
Even-aged, Turkey, Deer	3	388	263	267	240	239
Even-aged, Softwood	4	19	0	0	0	0
Wilderness	5	0	0	0	9	9
Recreation, Wildlife	6.1	29	218	200	216	213
Even-aged 10 yr. SPNM 30 yr.	6.2	1	1	1	1	2
Wetland Wildlife	6.3	0	0	0	0	0
Long Rotation Primitive	6.5	0	0	0	0	0
Developed Recreation	7	0	0	0	0	0
Special Areas	8	0	0	0	0	0
Minimum Level	9.1	6	6	15	18	18

Constraints Within Alternatives

TABLE B-81 ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE B
BY CONSTRAINT SET

ECONOMIC INDICATORS*	CONSTRAINT SETS (CS)				
	CS1 Max PNV BM	CS2 Timber	CS3 Rec/Wldlf	CS4 Wild./NRA	CS5 Pub.Rev
PRESENT NET VALUE (MM\$)	444	400	324	316	296
CHANGE PNV FROM MAX PNV WITH MMR	-44	-76	- 8	-20	
BENEFIT/COST RATIO	5.3	6.8	7.4	7.9	7.9

*Discount rate 4%.

Constraints Within Alternatives

TABLE B-82 ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE B BY ELEMENT

ECONOMIC INDICATORS*	CONSTRAINT SETS (CS)				
	CS1 Max PN _V BM	CS2 Timber	CS3 Rec/Wldlf	CS4 Wilder/NRA	CS5 Pub.Rev
<u>DISCOUNTED BENEFITS (MM\$)</u>					
<u>Element</u>					
Recreation	157	209	134	139	137
Wilderness	0	0	0	4	4
Wildlife	22	40	22	25	24
Timber	359	213	215	192	172
OGM	1	1	1	1	1
Support	1	1	1	1	1
<u>TOTALS</u>	539	464	372	362	339
<u>DISCOUNTED COSTS (MM\$)</u>					
<u>Element</u>					
Recreation	8	6	3	3	3
Wilderness	0	0	0	1	1
Wildlife	17	18	1	1	1
Timber	71	39	40	36	33
OGM	2	2	2	2	2
Support	3	3	4	3	3
<u>TOTALS</u>	101	68	50	46	43

*Discount Rate 4%

Constraints Within Alternatives

TABLE B-83 KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN
FOR ALTERNATIVE B BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS1		CS2		CS3	
	Max PNW M Units	BM M\$	Timber M Units	M\$	Rec/Wldlf M Units	M\$
<u>TIMBER</u>						
<u>LTSY (MBF/Year)</u>	119		66		67	
<u>Timber Volume (MBF/Decade)</u>						
<u>Hardwood Sawtimber</u>						
Decade 1	492	64320	298	46889	298	47868
2	678	93272	333	58569	330	57090
3	715	149055	392	70316	389	71132
4	780	164470	416	86192	415	87203
5	891	214730	440	91492	439	91574
10	510	72898	358	71616	362	74394
15	566	87097	349	62847	356	66772
<u>Softwood Sawtimber</u>						
Decade 1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
10	1	19	0	0	0	0
15	98	2782	0	0	0	0
<u>Hardwood Pulpwood</u>						
Decade 1	700	0	362	0	362	0
2	514	0	327	0	330	0
3	477	0	268	0	271	0
4	410	0	244	0	245	0
5	297	0	220	0	221	0
10	675	0	302	0	298	0
15	507	0	311	0	304	0
<u>Softwood Pulpwood</u>						
Decade 1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	2	13	0	0	0	0
5	4	29	0	0	0	0
10	6	45	0	0	0	0
15	21	169	0	0	0	0

Constraints Within Alternatives

TABLE B-83 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE B BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)			
	CS4		CS5	
	Wilder./NRA M Units	M\$	Public Review M Units	M\$
<u>TIMBER</u>				
<u>LTSY (MBF/Year)</u>	60		57	
<u>Timber Volume (MBF/Decade)</u>				
<u>Hardwood Sawtimber</u>				
Decade 1	265	42985	230	35198
2	288	50113	311	41391
3	343	64137	326	61880
4	370	77609	351	73137
5	392	82144	373	81319
10	323	66344	272	44896
15	318	59750	269	45691
<u>Softwood Sawtimber</u>				
Decade 1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
10	0	0	0	0
15	0	0	0	0
<u>Hardwood Pulpwood</u>				
Decade 1	330	0	337	0
2	308	0	256	0
3	253	0	241	0
4	225	0	216	0
5	204	0	194	0
10	273	0	295	0
15	278	0	298	0
<u>Softwood Pulpwood</u>				
Decade 1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	2	13	0	0
5	4	29	0	0
10	6	45	0	0
15	21	169	0	0

Constraints Within Alternatives

TABLE B-83 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN
FOR ALTERNATIVE B BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS1		CS2		CS3	
	Max M Units	PNV BM M\$	Timber M Units	M\$	Rec/Wldlf M Units	M\$
<u>TIMBER (con't)</u>						
<u>Total Timber Volume</u>						
Decade 1	1192	64320	660	46889	660	47868
2	1192	93272	660	58569	660	57090
3	1192	149055	660	70316	660	71132
4	1192	164483	660	86192	660	87203
5	1192	214759	660	91492	660	91574
10	1192	72962	660	71616	660	74394
15	1192	90048	660	62847	660	66772
<u>Final Harvest (acres)</u>						
Decade 1	26		36		37	
2	54		35		35	
3	35		27		27	
4	54		28		28	
5	50		23		23	
10	43		27		27	
15	36		27		27	
<u>Thinnings (acres)</u>						
Decade 1	106		3		1	
2	0		0		0	
3	84		1		0	
4	0		0		0	
5	1		1		0	
10	48		5		5	
15	40		0		1	
<u>Selection (acres)</u>						
Decade 1	40		16		17	
2	22		0		0	
3	40		16		17	
4	21		0		0	
5	40		16		17	
10	21		0		0	
15	40		16		17	

Constraints Within Alternatives

TABLE B-83 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE B BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)			
	CS4		CS5	
	Wilder./NRA M Units	M\$	Public Review M Units	M\$
<u>TIMBER (con't)</u>				
<u>Total Timber Volume</u>				
Decade 1	596	42985	567	35198
2	596	50113	567	41491
3	596	64137	567	61880
4	596	77609	567	73137
5	596	82144	567	81319
10	596	66344	567	44896
15	596	59750	567	45691
<u>Final Harvest (acres)</u>				
Decade 1	33		28	
2	31		26	
3	24		20	
4	25		22	
5	21		21	
10	24		25	
15	24		24	
<u>Thinnings (acres)</u>				
Decade 1	1		5	
2	0		13	
3	0		10	
4	0		15	
5	0		12	
10	4		11	
15	0		0	
<u>Selection (acres)</u>				
Decade 1	14		18	
2	0		0	
3	14		18	
4	0		0	
5	14		18	
10	0		0	
15	14		18	

Constraints Within Alternatives

TABLE B-83 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE B BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS1		CS2		CS3	
	Max PNV	BM	Timber		Rec/Wldlf	
	M Units	M\$	M Units	M\$	M Units	M\$
<u>TIMBER (con't)</u>						
<u>Herbicide (acres)</u>						
Decade 1	30	1044	25	875	26	890
2	36	1264	18	616	17	606
3	22	790	15	522	15	513
4	31	1057	14	488	14	487
5	34	1159	13	450	13	460
10	25	869	14	483	13	461
15	22	779	15	520	15	521
<u>RECREATION/WILDLIFE</u>						
<u>SPNM W033 (RVD/Decade)</u>						
Decade 1	0	0	1	5	1	5
2	0	0	1	5	1	5
3	0	0	1	10	1	10
4	0	0	1	10	1	10
5	0	0	1	5	1	5
10	0	0	1	5	1	5
15	0	0	1	10	1	10
<u>SPM W05 (RVD/Decade)</u>						
Decade 1	898	6994	6560	51106	4423	34453
2	920	7165	6725	52391	4423	34453
3	942	7336	6890	53676	4423	34453
4	970	7558	7062	55012	4438	34572
5	980	7644	7144	55658	4438	34572
10	980	7644	7144	55658	4438	34572
15	980	7644	7144	55658	4438	34572
<u>RN W07 (RVD/Decade)</u>						
Decade 1	8632	46614	4669	25210	3524	19030
2	9617	51929	5117	27634	3459	18676
3	10601	57245	5566	30057	3393	18323
4	11651	62916	6080	32834	3393	18323
5	12176	65751	6337	34222	3393	18323
10	12130	65502	6292	33975	3347	18076
15	12130	65502	6292	33975	3347	18076

Constraints Within Alternatives

TABLE B-83 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE B BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)			
	CS4		CS5	
	Wilder./NRA M Units	M\$	Public Review M Units	M\$
<u>TIMBER (con't)</u>				
<u>Herbicide (acres)</u>				
Decade 1	23	789	0	0
2	15	535	0	0
3	13	458	0	0
4	13	434	0	0
5	12	412	0	0
10	12	411	0	0
15	13	464	0	0
<u>RECREATION/WILDLIFE</u>				
<u>SPNM W0 33 (RVD/Decade)</u>				
Decade 1	106	982	121	1125
2	168	1562	183	1704
3	194	1803	225	2095
4	219	2038	251	2330
5	233	2151	248	2293
10	233	2151	248	2293
15	233	2151	264	2448
<u>SPM W05 (RVD/Decade)</u>				
Decade 1	4870	37940	4734	36881
2	4870	37940	4734	36881
3	4870	37940	4734	36881
4	4885	38053	4749	36994
5	4885	38053	4749	36994
10	4885	38053	4749	36994
15	4885	38053	4749	36994
<u>RN W07 (RVD/Decade)</u>				
Decade 1	3176	17150	3200	17282
2	3110	16797	3134	16924
3	3045	16444	3068	16565
4	3045	16444	3068	16565
5	3045	16444	3068	16565
10	2999	16196	3021	16314
15	2999	16196	3021	16314

Constraints Within Alternatives

TABLE B-83 (con't) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE B BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS1		CS2		CS3	
	Max PN	BM	Timber		Rec/Wldlf	
	M Units	M\$	M Units	M\$	M Units	M\$
<u>RECREATION (con't)</u>						
<u>Big-Game (WFUD/Decade)</u>						
Decade 1	1635	36400	1417	31548	1324	29470
2	1944	43267	1699	37830	1400	31160
3	2007	44680	1747	38892	1307	29089
4	1900	42299	1723	38357	1224	27254
5	1847	41123	1752	39003	1225	27275
10	1835	40853	1755	39073	1226	27296
15	1817	40447	1742	38781	1218	27115

Constraints Within Alternatives

TABLE B-83 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE B BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)			
	CS4		CS5	
	Wilder./NRA M Units	M\$	Public Review M Units	M\$
<u>RECREATION (con't)</u>				
<u>Big-Game (WFUD/Decade)</u>				
Decade 1	1274	28354	1285	28609
2	1350	30038	1322	29417
3	1269	28251	1252	27855
4	1199	26708	1210	26919
5	1203	26777	1212	26983
10	1103	26997	1194	26593
15	1199	26685	1162	25875

Constraints Within Alternatives

ALTERNATIVE C: Alternative C emphasizes the production of goods and services to maximize benefits which produce monetary returns. The max PNV benchmark is reflected in constraint set 1 and constraint set 2 addresses the timber problem statement. The objective is to manage timber crops for the highest value hardwood sawtimber species yielding the highest discounted returns. Constraint set 2 is made up of only 1 constraint. The constraint is an NDY requirement on hardwood sawtimber. The result of applying this constraint was a reduction of 6 percent in PNV of \$26 million. The benefit/cost ratio went from 5.3 to 5.8. By element the discounted benefits and costs decreased for timber. There was an increase in discounted benefits of \$9 million in the recreation element and \$6 million in the wildlife element. The NDY of hardwood sawtimber is binding in every period. The reduction in L_{TSY} between constraint sets 1 and 2 was 14.3 percent. This represents a difference of 17 MMBF per year.

The major differences in the timber element as a result of requiring NDY of hardwood sawtimber are the intensities of management prescription 3 chosen. The final harvest acres (Table B-87) goes from 26,000 acres in decade 1 prior to the addition of constraint set 2, to 60,000 acres after adding the constraint set. There were 106,000 acres of thinnings in constraint 1, this was reduced to 3,000 acres in constraint 2. This indicates that less intensive even-aged management is being brought into solution. The reason being the outputs from thinnings contain a larger proportion of hardwood pulpwood than final harvest cuts. All precommercial thinning intensities for all analysis areas, and the thinning intensities for Allegheny hardwoods, age 31-70 years, high-stocking analysis areas (which represents 135,000 acres) have a higher PNV than the final harvest intensities. Therefore, when NDY of total volume was the only constraint, the higher PNV precommercial thinning and thinning intensities were brought into solution. However, when the NDY of hardwood sawtimber constraint was added, the final harvest intensities were selected over the thinning intensities because they contained a larger proportion of the hardwood sawtimber, even though the PNV was higher for the thinnings.

Constraint set 3 addresses the recreation and wildlife problem statement. There are three constraints in this set. The purpose of these constraints is to keep new dispersed recreation development to a minimum and to invest in wildlife improvements only through timber management activities. The first constraint is to allow no medium or high recreation and wildlife intensities to come into solution. The second constraint allocates the 782 acres of Buzzard Swamp to management prescription 9.1. Buzzard Swamp is actually managed according to prescription 6.3. We added the additional costs outside of FORPLAN.

The final constraint in this set is to constrain 70 percent or 6,086 acres of the Allegheny Reservoir Face to a management prescription other than even-aged management. The application of these constraints results in meeting the objectives set forth in the recreation and wildlife portion of this alternative.

Table B-85 reveals that PNV dropped 16 percent or \$65 million as a result of adding constraint 3. The benefit/cost ratio rose from 5.8 to 6.2. The recreation and wildlife elements showed large decreases in both discounted benefits and costs (Table B-86). This was expected as a result of allowing no medium or high recreation and wildlife intensities into solution. The timber element showed a \$12 million increase in discounted benefits and \$3 million increase in discounted costs.

The allocation of management goals (Table B-84) indicates a reduction of 13,000 acres in the uneven-aged management prescription and 23,000 acre decrease in management prescription 6.1, the prescription which allows cutting only for recreation and wildlife purposes. Management prescription 3 (even-aged management) was the prescription receiving the largest increase going from 389,000 acres prior to the addition of constraint set 3 to 426,000 acres after, an increase of 37,000 acres. The result of this shift is a slight increase in timber yields between constraint sets 2 and 3. LTSY increases from 102 MMBF/year to 108 MMBF/year. The reason for this shift of more acres into 3 is due to the fact that with low recreation and wildlife intensities, the reduction in RVD's and WFUD's causes the marginal timber producing areas to be allocated to

3. At high recreation and wildlife intensities, these marginal timber producing AA's are more productive to manage under prescriptions other than 3.

The wilderness problem statement is addressed in constraint set 4. In this alternative, Hickory Creek and the Allegheny River Islands are allocated to the wilderness management prescription (5). The Allegheny NRA was constrained to management prescription 6.1. These constraints resulted in a reduction of 46,000 acres in management prescription 3. This was offset by gains in management prescriptions 2, 4, 5, 6.2, 6.1, and 9.1. Exact acreage gains can be seen in Table B-84. PNV decreases by 5 percent or \$16 million after adding constraint set 4. The benefit/cost ratio declines from 6.2 to 6.0. Total discounted benefits decrease by \$15 million. This decrease came completely out of the timber element since benefits in all other elements increased or remained the same between constraint set 3 and 4. Discounted costs went from \$69 million to \$68 million after the addition of the constraint set. Again, the reduction in discounted cost occurred in the timber element. In terms of the constraint sets effects on activities and outputs (Table B-87), timber related activities decreased, LTSY went from 108 MMBF/year to 100 MMBF/year and hardwood sawtimber volume declined by 56 MMBF/decade. There was a shift in recreation for roaded natural to the semi-primitive ROS class. There was a small decline in big-game WFUD's produced in all decades.

TABLE B-84: MANAGEMENT PRESCRIPTION ASSIGNMENTS FROM FORPLAN
FOR ALTERNATIVE C BY CONSTRAINT SET

Management Prescription		Total M Acres Assigned			
		CS1	CS2	CS3	CS4
		Max PNV BM	Timber	Rec/Wldlf	Wilder./NRA
Aspen, Grouse	1	0	0	0	0
Uneven-aged, Non-game	2	62	22	9	11
Even-aged, Turkey, Deer	3	388	389	426	380
Even-aged, Softwood	4	19	10	11	17
Wilderness	5	0	0	0	9
Recreation, Wildlife	6.1	29	72	49	69
Even-aged 10 yr. SPNM 30 yr.	6.2	1	5	1	6
Wetland Wildlife	6.3	0	0	0	0
Long Rotation Primitive	6.5	0	0	0	0
Developed Recreation	7	0	0	0	0
Special Areas	8	0	0	0	0
Minimum Level	9	6	6	7	11

Constraints Within Alternatives

TABLE B-85: ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE C
BY CONSTRAINT SET

ECONOMIC INDICATORS*	CONSTRAINT SETS (CS)			
	CS1	CS2	CS3	CS4
	Max PN _V BM	Timber	Rec/Wldlf	Wilder./NRA
PRESENT NET VALUE (MM\$)	444	418	353	337
CHANGE PN _V FROM MAX PN _V WITH MMR	-26	-65		-16
BENEFIT/COST RATIO	5.3	5.8	6.2	6.0

*Discount rate 4%.

TABLE B-86 ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE C BY ELEMENT

<u>ECONOMIC INDICATORS*</u>	<u>CONSTRAINT SETS (CS)</u>			
	<u>CS1</u>	<u>CS2</u>	<u>CS3</u>	<u>CS4</u>
	<u>Max PNV BM</u>	<u>Timber</u>	<u>Rec/Wldlf</u>	<u>Wilder./NRA</u>
<u>DISCOUNTED BENEFITS (MM\$)</u>				
<u>Element</u>				
<u>Recreation</u>	157	166	95	99
<u>Wilderness</u>	0	0	0	4
<u>Wildlife</u>	22	28	5	9
<u>Timber</u>	359	306	318	291
<u>OGM</u>	1	1	1	1
<u>Support</u>	1	1	1	1
<u>TOTALS</u>	539	501	420	405
<u>DISCOUNTED COSTS (MM\$)</u>				
<u>Element</u>				
<u>Recreation</u>	8	7	4	4
<u>Wilderness</u>	0	0	0	1
<u>Wildlife</u>	17	19	0	0
<u>Timber</u>	71	57	60	58
<u>OGM</u>	2	2	2	2
<u>Support</u>	3	3	3	3
<u>TOTALS</u>	101	87	69	68

*Discount Rate 4%

Constraints Within Alternatives

**TABLE B-87: KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN
FOR ALTERNATIVE C BY CONSTRAINT SET**

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)							
	CS1		CS2		CS3		CS4	
	Max PNV	BM	Timber		Rec/Wldlf		Wilderness/NRA	
	M Units	M\$	M Units	M\$	M Units	M\$	M Units	M\$
TIMBER								
LTSY (MBF/Year)	119		102		108		100	
Timber Volume (MBF/Decade)								
Hardwood Sawtimber								
Decade 1	492	64320	558	68207	575	71250	519	66705
2	678	93272	558	90293	575	95430	519	89756
3	715	149055	558	110524	575	112714	519	100690
4	780	164470	558	105781	575	101861	519	87683
5	891	214730	558	109039	575	113001	519	105731
10	510	72898	558	101481	575	89017	519	86740
15	566	87097	558	104319	575	90884	519	99451
Softwood Sawtimber								
Decade 1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
10	1	19	23	992	108	4599	90	3834
15	98	2782	100	2591	89	2136	143	3728
Hardwood Pulpwood								
Decade 1	700	0	458	0	491	0	480	0
2	514	0	458	0	491	0	480	0
3	477	0	458	0	491	0	480	0
4	410	0	435	0	464	0	439	0
5	297	0	410	0	435	0	394	0
10	675	0	432	0	369	0	379	0
15	507	0	340	0	373	0	305	0
Softwood Pulpwood								
Decade 1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	2	13	23	186	27	215	41	329
5	4	29	48	391	56	452	86	694
10	6	45	3	24	14	109	11	92
15	21	169	18	147	28	229	32	257

Constraints Within Alternatives

TABLE B-87 (CON'T): KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE C BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)							
	CS1		CS2		CS3		CS4	
	Max PNW	BM	Timber		Rec/Wldlf		Wilderness/NRA	
	M Units	M\$	M Units	M\$	M Units	M\$	M Units	M\$
<u>Total Timber Volume</u>								
Decade 1	1192	64320	1016	68207	1066	71250	999	66705
2	1192	93272	1016	90293	1066	95430	999	89756
3	1192	149055	1016	110524	1066	112714	999	100690
4	1192	164483	1016	105967	1066	102076	999	88012
5	1192	214759	1016	109430	1066	113453	999	106425
10	1192	72962	1016	102497	1066	93725	999	90666
15	1192	90048	1016	107057	1066	93249	999	103436
<u>Final Harvest (acres)</u>								
Decade 1	26		60		64		66	
2	54		53		56		53	
3	35		45		45		40	
4	54		38		43		42	
5	50		41		42		35	
10	43		39		40		38	
15	36		40		40		37	
<u>Thinnings (acres)</u>								
Decade 1	106		3		3		3	
2	0		0		0		0	
3	84		15		24		37	
4	0		3		11		4	
5	1		19		27		36	
10	48		7		11		7	
15	40		6		15		7	
<u>Selection (acres)</u>								
Decade 1	40		2		3		2	
2	22		0		1		0	
3	40		2		6		6	
4	21		19		2		5	
5	40		2		6		6	
10	21		19		2		5	
15	40		2		6		6	

Constraints Within Alternatives

TABLE B-87 (CON'T): KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE C BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)							
	CS1		CS2		CS3		CS4	
	Max PNV M Units	BM M\$	Timber M Units	M\$	Rec/Wldlf M Units	M\$	Wilderness/NRA M Units	M\$
<u>Herbicide (acres)</u>								
Decade 1	30	1044	27	935	28	995	27	932
2	36	1264	27	924	28	978	27	923
3	22	790	23	807	24	842	22	751
4	31	1057	28	964	22	783	23	800
5	34	1159	21	723	22	750	18	631
10	25	869	22	762	20	706	20	684
15	22	779	22	768	22	779	20	698
<u>RECREATION/WILDLIFE</u>								
<u>SPNM W03 (RVD/Decade)</u>								
Decade 1	0	0	50	464	7	63	143	1322
2	0	0	58	535	7	63	198	1502
3	0	0	108	1000	14	130	259	2407
4	0	0	112	1039	14	130	277	2579
5	0	0	73	633	7	63	245	2268
10	0	0	73	633	7	63	245	2268
15	0	0	114	1059	14	130	287	2665
<u>SPM W05 (RVD/Decade)</u>								
Decade 1	898	6994	2228	17355	1127	8777	1519	11831
2	920	7165	2282	17776	1127	8777	1519	11831
3	942	7336	2336	18197	1127	8777	1519	11831
4	970	7558	2396	18668	1134	8834	1526	11887
5	980	7644	2423	18879	1134	8834	1526	11887
10	980	7644	2423	18879	1134	8834	1526	11887
15	980	7644	2423	18879	1134	8834	1526	11887
<u>RN W07 (RVD/Decade)</u>								
Decade 1	8632	46614	7415	40043	5427	29306	5015	27082
2	9617	51929	8200	44282	5362	28953	4950	26729
3	10601	57245	8985	48521	5296	28600	4884	26376
4	11651	62916	9836	53113	5296	28600	4884	26376
5	12176	65751	10261	55409	5296	28600	4884	26376
10	12130	65502	10215	55161	5251	28353	4839	26128
15	12130	65502	10215	55161	5251	28353	4839	26128

Constraints Within Alternatives

TABLE B-87 (CON'T): KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE C BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)							
	CS1		CS2		CS3		CS4	
	Max PNV	BM	Timber		Rec/Wldlf		Wilderness/NRA	
	M Units	M\$	M Units	M\$	M Units	M\$	M Units	M\$
Big-Game (WFUD/Decade)								
Decade 1	1635	36400	1598	35564	1544	34379	1462	32549
2	1944	43267	1967	43781	1639	36389	1560	34713
3	2007	44680	1997	44453	1501	33415	1429	31806
4	1900	42299	1899	42279	1385	30834	1314	29256
5	1847	41123	1882	41895	1374	30580	1313	29226
10	1835	40853	1920	42732	1382	30757	1329	29597
15	1817	40447	1876	41755	1358	30224	1310	29154

Constraints Within Alternatives

ALTERNATIVE D: The purpose of Alternative D is to emphasize increases in the production of both market and non-market goods and services over current levels. The first constraint set contains a set of common and structural constraints common to all alternatives. This set of constraints also represents the constraints used in the MAX PNW benchmarks. Constraint set 2 addressed the timber problem statement. Final harvest acres will be increased. Timber type conversion is allowed on the most productive sites. The actual constraints in this constraint set are: 1) a minimum of 420 MMBF of hardwood sawtimber in periods 1 to 5, 2) final harvest a minimum of 30,000 acres in periods 1 and 2, and 3) 0 acres of low-site oak analysis areas allocated to a conversion prescription. The application of this constraint set reduces PNW by \$2 million or 0.5 percent. The benefit/cost ratio increases from 5.3 to 5.4. While the final harvest constraint is binding in period 1, the overall effect of this constraint set in terms of total PNW is small.

Examination of Table B-90 indicates a slight increase in discounted benefits in both the wildlife and timber elements after the addition of constraint set 2 in Alternative D. These increases are \$2 million and \$1 million, respectively. A decrease of \$7 million occurred in the discounted benefits associated with the recreation element. Overall discounted benefits were reduced by \$3 million as a result of this constraint set. The effects on discounted costs resulted in an increase of \$3 million in the wildlife element. The recreation element had a \$2 million decrease and the timber element showed a \$3 million decrease. Total discounted cost dropped by \$1 million.

While the change in discounted costs and benefits as a result of adding constraint set 2 were small, there was a change in the management prescriptions allocated. The most significant change is an increase of 66,000 acres being allocated to prescription 3 and a decrease of 44,000 and 19,000 in prescriptions 2 and 4, respectively. This change in allocation is a result of not allowing low site oak to be converted to conifer, maintaining existing savannahs, and increasing final harvest acres on the remaining areas. Even though more acres are allocated to even-aged management (management prescription 3), the L_{TSY} after adding constraint set 2

is decreased by 5 MMBF/year. Hardwood sawtimber volume in period 1 is higher after the constraint set is added, going from 492 MMBF/period to 507 MMBF/period.

Total timber volume, however, is decreased by 53 MMBF in the first period. The increase in hardwood sawtimber results from the need to final harvest 30,000 acres in period 1. The ratio of sawtimber to pulpwood is higher with final harvests than with thinnings. By increasing the final harvests in period 1, both sawtimber volume and total volume are reduced in the remaining periods.

The effects of this constraint set on RVD's was not very significant. The largest percent decrease in RVD's occurred in the semi-primitive motorized ROS class which decreased by 15 percent after the addition of the constraint. This was a result of the 16 percent in decrease in acres allocated to management prescription 6.1. There was a slight increase in the semi-primitive non-motorized RVD's due to a small increase in the acres allocated to management prescription 6.2. Because of the increased acres allocated to even-aged management, the number of big-game WFUD's increased slightly (6 percent) after adding constraint set 2.

The recreation and wildlife problem statement is addressed by constraint set 3. The recreation and wildlife objectives of this alternative are: 1) manage at least 15 percent of the forest to provide a semi-primitive, dispersed recreation experience, and 2) emphasize a moderate increase of hunting opportunities in areas managed to provide timber outputs. The constraints used to meet these objectives were: 1) assign 25,281 acres around Allegheny Reservoir including Tracy Ridge and Cornplanter to management prescription 6.1 high recreation/ wildlife intensity; 2) assign 57,288 acres which includes Hickory Creek, Allegheny Front, Minister Valley, and Clarion River areas to management prescriptions 5, 6.1, or 9.1; 3) constrain major river corridors to management prescription 6.1; 4) constrain low and high recreation/wildlife intensities to 0 acres on all timber management prescriptions; and 5) Buzzard Swamp to management prescription 9.1.

The application of this constraint set reduced the PNV of Alternative D by \$36 million. The benefit/cost ratio increased from 5.4 to 6.4. The increase in the B/C ratio was a result of a 26 percent decrease in discounted costs and only 11 percent reduction in

discounted benefit. The only element to show an increase in discounted benefits was the recreation element which increased \$3 million, from \$150 million to \$153 million. As indicated in Table B-90, the discounted benefits in the wildlife and timber elements decreased by \$2 million and \$59 million, respectively, as a result of constraint set 3. Total discounted benefits decreased by \$58 million.

Table B-90 also displays the effects on discounted costs of adding constraints to Alternative D. The addition of constraint set 3 decreases discounted costs in the recreation, wildlife, and timber elements. Discounted costs on the recreation element went from \$7 million to \$6 million, in the wildlife element for \$20 million to \$9 million, and in the timber element from \$68 million to \$54 million. Total discounted costs decreased by \$26 million.

The most important point of this table is even though the total PNW decreases as a result of adding constraint set 3, the PNW of the recreation and wildlife elements actually increase. This is a result of the objectives of the constraint set which was designed to increase the emphasis placed on recreation and wildlife.

Table B-88, which displays management prescription allocation by constraint set, shows that constraint set 3 causes a shift in management prescriptions from 2 and 3 to 6.1. Management prescription 2 decreases from 18,000 acres to less than 1,000 acres; prescription 3 decreases by 72,000 acres from 454,000 acres to 382,000 acres. Management prescription 6.1 increases by 87,000 from 25,000 to 112,000 acres. This change in prescription assignment is a direct result of the requirement to increase the amount of semi-primitive dispersed recreation available on the Forest.

The effects of constraint set 3 on specific activities and outputs is displayed in Table B-91. As a result of the increased emphasis on semi-primitive recreation activities and outputs, the timber element decreased. L_{TSY} went from 114 MMBF/year to 93 MMBF/year. Total timber volumes as well as individual products decreased in every period. As expected, the addition of constraint set 3 caused a large increase in semi-primitive motorized RVD's and a significant decrease in the roaded natural ROS class. In the first

period, RVD's in the semi-primitive motorized ROS class increased 329 percent while roaded natural RVD's decreased by 33 percent in the same period. The three fold increase in semi-primitive ROS class RVD's was a direct result of the three fold increase in the allocation of management prescription of 6.1. The decrease in roaded natural RVD's was a result of two criteria imposed, the first was the reduction of acres allocated to prescription 3, the second was the fact that those acres allocated to 3 could only receive a medium recreation/wildlife intensity. The application of constraint set 3 actually reduced the big-game WFUD's produced by 13 percent in period 1. The reason for this is because the constraint requiring management prescription 3 to receive a medium intensity recreation/wildlife intensity will reduce the number of WFUD's from these areas. In addition, fewer acres going to 3 will reduce WFUD's produced because there will be less acres in the younger age classes where more WFUD's are generated.

Constraint set 4 in Alternative D requires Hickory Creek and the Allegheny River Islands be allocated to the Wilderness management prescription (5). The Allegheny NRA was constrained to management prescription 6.1. As a result of this constraint, the PNV is reduced from \$406 million to \$401 million. The benefit/cost ratio increased from 6.4 to 6.5. Discounted benefits decrease in the recreation element and timber element by \$4 and \$5 million, respectively. Increases occurred in the Wilderness element of \$4 million. The wildlife element did not change. In terms of discounted costs, the recreation and timber element both decreased by \$1 million, the wilderness element increased by \$1 million, and again the wildlife element remained unchanged.

In terms of the allocation by management prescription for constraint set 4, management prescriptions 6.1 and 3 were reduced by 6,000 acres and 4,000 acres, respectively. Management prescription 5 increased by 10,000 acres. The change in allocation was a direct result of the constraint on Wilderness areas.

The effects of key activities and outputs as a result of this constraint are minimal. LTSY decreased by 1 MMBF/year. A small reduction occurred in the roaded natural and semi-primitive motorized RVD's, and a small

increase occurred in semi-primitive non-motorized RVD's. There were no significant changes in either timber activities or outputs as in big-game WFUD's.

Constraint set 5 in Alternative D was added after choosing a preferred alternative in the Draft EIS. Based on mapping and spatial feasibility testing, constraints on management prescription assignments were made to improve the spatial arrangement of prescriptions. The addition of constraint set 5 reduced PNW by \$3 million to \$398 million. The benefit/cost ratio increased to 6.7. The reason PNW decreased is because the absolute decrease in discounted benefits (\$5 million) is greater than the absolute decrease in discounted costs (\$3 million) when compared to the previous constraint set. The reason the benefit/cost ratio increased when constraint set 5 was added is because the percent decrease in discounted benefits (1 percent) is less than the percent decrease in discounted costs (4 percent). Discounted benefits in the recreation and wildlife elements increased by \$15 million and \$5 million, respectively. Discounted benefits decreased by \$25 million in the timber element. Discounted costs decreased by \$4 million in the timber element, increased by \$1 million in the wildlife element, and remained unchanged in the recreation element.

Constraint set 5 caused increases of 5,000 acres in management prescription 2, 5,000 acres in management prescription 6.2, and 39,000 acres in management prescription 6.1. The only decrease in prescription allocation took place in prescription 3, which was reduced by 50,000 acres.

As a result of the shift in the assignment of management prescriptions, changes occurred in activities and outputs of all elements. LTSY was reduced by 8 MMBF/year with volume of all products harvested reduced. Because of the increase in acres assigned to uneven-aged management, there was an increase in the acres receiving selection harvest.

RVD's increased in the semi-primitive motorized and non-motorized ROS class and decreased in the roaded natural ROS class. The RVD's in the semi-primitive non-motorized ROS class increased by 256 percent. This increase is due to the increased acres in management prescription 6.2. This prescription has 30 years of

Constraints Within Alternatives

"quiet" periods when no timber harvesting is allowed and 10 years of timber harvesting. During the "quiet" period, semi-primitive RVD's are produced. There was a 37 percent increase in semi-primitive motorized ROS class due to the shift in prescription assignment from 3 to 6.1. This is the same reason for the 12 percent decrease in roaded natural RVD's.

Big-game WFUD's declined slightly (4 percent) as a result of the addition of constraint set 5. WFUD production is higher in young age class timber than old age timber. By reducing the acres in management prescription 3, WFUD's produced are reduced because less acres are in the young age classes. Some of the reduction in WFUD's due to less acres of young age class timber is offset by the switch from medium recreation/wildlife intensity, which is constrained in management 3, to high recreation/wildlife intensity assigned in management prescription 6.1. However, the shift from medium to high intensity did not generate enough WFUD's to offset the reduction of acres in the young age class.

The final constraint set in Alternative D was added after public review of the Draft EIS. It represents the changes made in Alternative D in response to public comments. A summary of the constraints added are 1) provide 7,000 acres of aspen/grouse management, 2) increase acres of management prescription 6.2 to 20,000 acres, 3) allow no oak conversion, 4) no more than 30,000 acres of final harvest in decade 1, and 5) provide 15,000 acres of old growth in even-aged management prescriptions.

The addition of constraint set 6 reduced PNV by \$14 million to \$384 million. The benefit/cost ratio decreased to 5.9. The decrease in PNV and benefit/cost ratio resulted from a decrease in discounted benefits and an increase in discounted costs after the addition of the constraint set. Discounted benefits decreased by 1 percent from \$468 million to \$462 million. Discounted benefits decreased by \$8 million in the recreation element and \$1 million in the wildlife element. The only element to increase in discounted benefits was timber with a \$3 million increase. Discounted costs increased by 10 percent from \$70 million to \$78 million. The entire increase in discounted costs took place in the timber element.

Constraint set 6 caused increases of 7,000 acres in management prescription 1 and 15,000 acres in management prescription 6.2. A decrease of 1,000 acres in management prescription 3 and 21,000 acres in management prescription 6.1 also occurred.

As a result of the constraints added in constraint set 6, changes occurred in activities and outputs of all elements. LTSY increased by 5 million MMBF/year, however, hardwood sawtimber volume decreased in decade 1 from 420 MMBF to 347 MMBF. Pulpwood increased from 414 MMBF to 539 MMBF in decade 1. This result is directly related to the constraint which requires no oak conversion. In order to maintain total volume, harvest occurred in stands where the ratio of pulpwood to sawtimber was higher than in the oak stands, which was cut prior to adding the no conversion constraint. Also to offset the volume loss from not final harvesting the oak stands in decade 1, thinnings and selection cuts were increased in the first period.

The major shift in the recreation element was a doubling of the RVD's in the semi-primitive non-motorized ROS class. This was a result of the increase of 15,000 acres in management prescription 6.2. A reduction of 16 percent occurred in the semi-primitive motorized ROS class because of the reduction of acres in management prescription 6.1.

Big-game WFUD's increased slightly (2 percent) as a result of placing 7,000 acres in management prescription 1. WFUD production is higher on the acres managed intensively for grouse.

In summary, while all constraint sets had some effect on the development of alternative D, constraint set 3 seems to have the greatest significance. This constraint set addresses the recreation/wildlife problem statement. The other constraint set reduced PNV by \$2 million to \$5 million constraint set 3 reduced it by \$36 million over constraint set 2. There was a significant shift from management prescription which harvest timber to management prescription 6.1 in constraint set 3. As a result, the RVD's by ROS class changed significantly. There was a 329 percent increase in semi-primitive motorized RVD's and a 33 percent reduction in the roaded natural ROS class.

TABLE B-88: MANAGEMENT PRESCRIPTION ASSIGNMENTS FROM FORPLAN
FOR ALTERNATIVE D BY CONSTRAINT SET

Management Prescription	Total M Acres Assigned					
	CS1 Max PNV	CS2 BM Timber	CS3 Rec/Wldlf	CS4 Wilder./NRA	CS5	CS6 Pub. Rev.
Aspen, Grouse - 1	0	0	0	0	0	7
Uneven-aged, Non-Game - 2	62	18	1	1	6	6
Even-aged, Turkey, Deer - 3	388	454	382	378	328	327
Even-aged, Softwood - 4	19	0	0	0	0	0
Wilderness - 5	0	0	0	10	10	10
Recreation, Wildlife - 6.1	29	25	112	106	145	124
Even-aged 10 yr. SPNM 30 yr. - 6.2	<1	<1	<1	<1	5	20
Wetland Wildlife - 6.3	0	0	0	0	0	0
Long Rotation Primitive - 6.5	0	0	0	0	0	0
Developed Recreation - 7	0	0	0	0	0	0
Special Areas - 8	0	0	0	0	0	0
Minimum Level - 9.1	6	7	9	9	9	9

Constraints Within Alternatives

TABLE B-89 ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE D BY CONSTRAINT SET

ECONOMIC INDICATORS*	CONSTRAINT SETS (CS)					
	CS1 Max PNV BM	CS2 Timber	CS3 Rec/Wldlf	CS4 Wild./NRA	CS5	CS6 Pub. Rev.
PRESENT NET VALUE (MM\$)	444	442	406	401	398	384
CHANGE PNV FROM MAX PNV WITH MMR	- 2	-36	- 5	- 3		-14
BENEFIT/COST RATIO	5.3	5.4	6.4	6.5	6.7	5.9

*Discount rate 4%.

Constraints Within Alternatives

TABLE B-90 ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE D BY ELEMENT

ECONOMIC INDICATORS*	CONSTRAINT SETS (CS)					
	CS1	CS2	CS3	CS4	CS5	CS6
	Max PNV BM	Timber	Rec/Wldlf	Wild./NRA		Pub. Rev.
<u>DISCOUNTED BENEFITS (MM\$)</u>						
<u>Element</u>						
Recreation	157	150	153	149	164	156
Wilderness	0	0	0	4	4	4
Wildlife	22	24	22	22	27	26
Timber	359	360	301	296	271	274
OGM	1	1	1	1	1	1
Support	1	1	1	1	1	1
<u>TOTALS</u>	539	536	478	473	468	462
<u>DISCOUNTED COSTS (MM\$)</u>						
<u>Element</u>						
Recreation	8	7	6	5	5	5
Wilderness	0	0	0	1	1	1
Wildlife	17	20	9	9	10	10
Timber	71	68	54	53	49	57
OGM	2	2	2	2	2	2
Support	3	3	3	3	3	3
<u>TOTALS</u>	101	100	74	73	70	78

*Discount Rate 4%

Constraints Within Alternatives

TABLE B-91 KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN
FOR ALTERNATIVE D BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS1		CS2		CS3	
	Max PNV	BM	Timber		Rec/Wldlf	
	M Units	M\$	M Units	M\$	M Units	M\$
<u>TIMBER</u>						
<u>LTSY (MBF/Year)</u>	119		114		93	
<u>Timber Volume (MBF/Decade)</u>						
Hardwood Sawtimber						
Decade 1	492	64320	507	60784	421	53246
2	678	93272	639	98289	494	79893
3	715	149055	692	145714	585	130793
4	780	164470	750	162208	587	125470
5	891	214730	836	191687	630	141543
10	510	72898	490	88818	479	87387
15	566	87097	651	119492	549	113493
Softwood Sawtimber						
Decade 1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
10	1	19	0	0	0	0
15	98	2782	0	0	0	0
Hardwood Pulpwood						
Decade 1	700	0	637	0	514	0
2	514	0	492	0	425	0
3	477	0	451	0	359	0
4	410	0	395	0	348	0
5	297	0	300	0	290	0
10	675	0	657	0	457	0
15	507	0	489	0	387	0
Softwood Pulpwood						
Decade 1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	2	13	0	0	0	0
5	4	29	0	0	0	0
10	6	45	0	0	0	0
15	21	169	0	0	0	0

Constraints Within Alternatives

TABLE B-91 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE D BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS4		CS5		CS6	
	Wilder./NRA M Units	M\$	M Units	M\$	Public Rev. M Units	M\$
<u>TIMBER</u>						
<u>LTSY (MBF/Year)</u>	92		84		89	
<u>Timber Volume (MBF/Decade)</u>						
Hardwood Sawtimber						
Decade 1	421	52850	420	51382	347	50677
2	478	79100	420	73230	426	56451
3	575	128260	508	109524	541	115692
4	579	123797	528	113469	555	121698
5	620	139110	567	128443	617	128325
10	465	86046	378	69284	486	90144
15	534	108687	467	96461	491	93272
Softwood Sawtimber						
Decade 1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
10	1	19	0	0	0	0
15	98	2782	0	0	0	0
Hardwood Pulpwood						
Decade 1	700	0	637	0	539	0
2	514	0	492	0	460	0
3	477	0	451	0	345	0
4	410	0	395	0	331	0
5	297	0	300	0	269	0
10	675	0	657	0	400	0
15	507	0	489	0	395	0
Softwood Pulpwood						
Decade 1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	2	13	0	0	0	0
5	4	29	0	0	0	0
10	6	45	0	0	0	0
15	21	169	0	0	0	0

Constraints Within Alternatives

TABLE B-91 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE D BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS1		CS2		CS3	
	Max PN	BM	Timber		Rec/Wldlf	
	M Units	M\$	M Units	M\$	M Units	M\$
<u>Total Timber Volume</u>						
Decade 1	1192	64320	1139	60784	931	53246
2	1192	93272	1139	98289	931	79893
3	1192	149055	1139	145714	931	130793
4	1192	164483	1139	162208	931	125470
5	1192	214759	1139	191687	931	141543
10	1192	72962	1139	88818	931	87387
15	1192	90048	1139	119492	931	113493
<u>Final Harvest (acres)</u>						
Decade 1		26		30		30
2		54		58		49
3		35		37		48
4		54		60		43
5		50		54		39
10		43		44		53
15		36		45		43
<u>Thinnings (acres)</u>						
Decade 1		106		112		87
2		0		0		0
3		84		92		31
4		0		0		0
5		1		1		0
10		48		65		9
15		40		29		16
<u>Selection (acres)</u>						
Decade 1		40		14		1
2		22		3		0
3		40		14		1
4		21		3		0
5		40		14		1
10		21		3		0
15		40		15		1

Constraints Within Alternatives

TABLE B-91 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE D BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS4		CS5		CS6	
	Wilder./NRA M Units	M\$	M Units	M\$	Public Rev. M Units	M\$
<u>Total Timber Volume</u>						
Decade 1	917	52850	834	51382	886	50677
2	917	79100	834	73230	886	56451
3	917	128260	834	109524	886	115692
4	917	123797	834	113469	886	121698
5	917	139110	834	128443	886	128325
10	917	86046	834	69284	886	90144
15	917	108687	834	96461	886	93272
<u>Final Harvest (acres)</u>						
Decade 1	83		30		30	
2	48		44		31	
3	48		41		44	
4	42		38		28	
5	39		34		37	
10	52		46		38	
15	43		40		40	
<u>Thinnings (acres)</u>						
Decade 1	83		60		87	
2	0		0		71	
3	30		22		18	
4	0		0		70	
5	0		2		19	
10	13		6		42	
15	13		7		1	
<u>Selection (acres)</u>						
Decade 1	1		3		7	
2	0		3		0	
3	1		3		7	
4	0		3		0	
5	1		3		7	
10	0		3		0	
15	1		3		7	

Constraints Within Alternatives

TABLE B-91 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN
FOR ALTERNATIVE D BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS1		CS2		CS3	
	Max PNV M Units	BM M\$	Timber M Units	M\$	Rec/Wldlf M Units	M\$
<u>Herbicide (acres)</u>						
Decade 1	30	1044	21	726	15	526
2	36	1264	30	1059	24	848
3	22	790	21	738	29	989
4	31	1057	33	1128	22	748
5	34	1159	33	1136	21	717
10	25	869	23	807	30	1040
15	22	779	25	864	24	820
<u>RECREATION/WILDLIFE</u>						
<u>SPNM W03 (RVD/Decade)</u>						
Decade 1	0	0	2	12	1	11
2	0	0	1	11	2	15
3	0	0	2	19	3	28
4	0	0	2	18	3	32
5	0	0	1	5	3	24
10	0	0	1	5	3	24
15	0	0	2	13	4	34
<u>SPM W05 (RVD/Decade)</u>						
Decade 1	898	6994	785	6112	3366	26219
2	920	7165	803	6260	3450	26874
3	942	7336	822	6408	3534	27528
4	970	7558	847	6596	3625	28239
5	980	7644	857	6674	3667	38566
10	980	7644	857	6674	3667	38566
15	980	7644	857	6674	3667	38566
<u>RN W07 (RVD/Decade)</u>						
Decade 1	8632	46614	8425	45496	5622	30359
2	9617	51929	9323	50346	5919	31964
3	10601	57245	10222	55197	6216	33568
4	11651	62916	11185	60400	6579	33525
5	12176	65751	11667	63002	6760	36504
10	12130	65502	11621	62755	6741	36257
15	12130	65502	11621	62755	6741	36257

Constraints Within Alternatives

TABLE B-91 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE D BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS4		CS5		CS6	
	Wilder./NRA M Units	M\$	M Units	M\$	Public Rev. M Units	M\$
<u>Herbicide (acres)</u>						
Decade 1	15	526	16	557	18	612
2	24	841	23	810	16	564
3	28	969	23	821	26	904
4	21	737	19	672	14	478
5	20	704	18	627	20	700
10	29	1012	25	863	21	724
15	24	817	22	748	22	753
<u>RECREATION/WILDLIFE</u>						
<u>SPNM WO3 (RVD/Decade)</u>						
Decade 1	41	384	146	1357	296	2757
2	122	1133	206	1917	417	3870
3	203	1891	269	2580	658	6101
4	284	2640	290	2694	732	6816
5	324	3004	259	2403	605	5610
10	324	3004	259	2403	605	5610
15	325	3014	301	2792	771	7148
<u>SPM WO5 (RVD/Decade)</u>						
Decade 1	3180	24774	4369	33661	3678	28653
2	3180	24774	4479	34891	3723	29004
3	3180	24774	4589	35748	3768	29354
4	3187	24831	4706	36661	3820	29761
5	3187	24831	4761	37090	3842	30201
10	3187	24831	4761	37090	3842	30201
15	3187	24831	4761	37090	3842	30201
<u>RN WO7 (RVD/Decade)</u>						
Decade 1	5549	29964	4869	26294	4994	26968
2	5841	31541	5115	27623	5246	28331
3	6133	33118	5362	28953	5499	29694
4	6490	35048	5673	30635	5817	31409
5	6669	36013	5829	31477	5975	32267
10	6623	35766	5783	31230	5930	32020
15	6623	35766	5783	31230	5930	32020

Constraints Within Alternatives

TABLE B-91 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE D BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS1		CS2		CS3	
	Max PNv BM		Timber		Rec/Wldlf	
	M Units	M\$	M Units	M\$	M Units	M\$
<u>Big-Game (WFUD/Decade)</u>						
Decade 1	1635	36400	1738	38677	1513	33682
2	1944	43267	2090	46541	1660	36959
3	2007	44680	2195	48875	1738	38683
4	1900	42299	2081	46323	1744	38808
5	1847	41123	2055	45839	1694	37753
10	1835	40853	2015	44845	1711	38086
15	1817	40447	2029	45159	1727	38465

Constraints Within Alternatives

TABLE B-91 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE D BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)					
	CS4		CS5		CS6	
	Wilder./NRA M Units	M\$	M Units	M\$	Public Review M Units	M\$
Big-Game (WFUD/Decade)						
Decade 1	1505	33523	1445	32168	1471	32753
2	1647	36651	1598	35577	1621	36069
3	1721	38306	1662	36990	1685	37515
4	1727	38434	1669	37150	1744	38817
5	1679	37363	1643	36573	1706	37964
10	1693	37682	1651	36743	1684	37500
15	1710	38063	1652	36781	1707	37999

Constraints Within Alternatives

ALTERNATIVE E: Alternative E emphasizes significant increases in the production of both priced and non-priced goods and services. Constraint set 1 is the max PNV benchmark and serves as the base in the incremental analysis. Constraint set 2 addresses the timber problem statement. The objectives of this alternative in terms of the timber problem statement are: 1) provide a natural-looking Forest recreation setting on approximately 25 percent of the Forest, 2) practice intensive timber management on the best sites, and 3) maintain the current level of sawtimber harvest volume. To meet these objectives four constraints were applied. The first was to allow no even-aged management on low-site oak and low CAP medium and high-stocking analysis areas. The second constraint was not to allow management prescription 3 or 6.2 on low-stocked analysis areas. The third constrained out the final harvest intensity in management prescription 3. The final constraint required a minimum of 250 MMBF of hardwood sawtimber in period 1.

A \$15 million reduction in PNV occurred as a result of the addition of constraint set 2. The benefit/cost ratio decreased from 5.3 to 5.1. The reduction in the benefit/cost ratio was a result of an increase in discounted costs and a decrease in discounted benefits after the addition of the constraint set. In terms of discounted benefits, there was a \$12 million increase in the recreation element. This was more than offset by a \$24 million decrease in the timber element. Discounted benefits in the wildlife element increased by \$1 million. Discounted costs in the timber element showed a \$4 million increase. Several reasons exist for the decrease in PNV. The financial analysis indicates prescription 3 - "final harvest only" intensities have a higher PNV per acre than prescription 3 - "thinning" intensities with no precommercial thinnings. This is true in all cases except for the Allegheny Hardwood, age 31-70, high stocked analysis areas. Therefore, the constraint on final harvest intensity reduces the PNV of the Alternative. In addition, since the PNV's for management prescription 3 are higher than any other management prescription, the restrictions on even-aged management prescriptions and timber type conversion constraint also reduced PNV of the Alternative.

Constraints Within Alternatives

Because of the constraints applied, less acres are available for even-aged management. This results in acres being shifted from the even-aged management prescriptions of 3 and 4 to uneven-aged prescriptions (2) and prescriptions which do not harvest timber, like 6.1 (Table B-92). The effects of this allocation include a reduction in the LTSY between the two runs. Since the acres assigned management prescription 3 are more intensively managed, an increase in acres thinned occurs. Also, more acres of selection cutting are done because of the increased acres in management prescription 2.

The most significant effects of this constraint set on other elements was a 100 percent increase in the number of semi-primitive motorized RVD's produced. The increase can be directly related to the doubling of acres being allocated to management prescription 6.1. The increase in semi-primitive non-motorized RVD's was a result of the 17,000 acre increase in management prescription 6.2. Management prescription 6.2 came into solution in large amounts on a few analysis areas. On these analysis areas, the management prescription and intensity replaced by 6.2, was 3 final harvest. The reason is the semi-primitive non-motorized RVD's produced in 6.2 are more valuable than the roaded natural RVD's produced in 3. When the final harvest intensity was constrained out of solution, the contribution to PNV from 3 and 6.2 were about the same; but the higher valued RVD's made management prescription 6.2 more desirable overall.

The constraints in the third constraint set address the recreation and wildlife problem statement. The objectives are to provide approximately 35,000 acres of recreational opportunity in the non-motorized ROS classes. In addition, intensive management of both game and non-game wildlife species will occur in this alternative. The constraints applied are: 1) increase beginning final harvest to culmination of mean annual increment of dollars, 2) allow no even-aged management around the Allegheny Reservoir (approximately 8,695 acres), 3) emphasize non-motorized recreation in Minister Valley (1,967 acres) by applying management prescription 6.1, 4) apply high intensity recreation and wildlife on 180,000 acres, 5) intensively manage existing aspen acreage for grouse (9,664 acres), and 6) constrain the core area of Buzzard Swamp to 9.1.

Table B-93 indicates a drop of 12 percent or \$50 million in the PNV as a result of adding constraint set 3. Benefit/cost ratio increases from 5.1 to 5.3, the same ratio as in the Max PNV run. In looking at Table B-94, the discounted benefits and costs by element, the most significant reduction occurs in the discounted benefits from the timber element, this decreases \$97 million between the two runs. The discounted benefits increase \$33 million in recreation. There are no significant changes in discounted costs, with the exception of an \$11 million decrease in the timber element.

Table B-92 indicates that a major shift occurred in management prescription allocation. Both management prescriptions 2 and 6.1 doubled in the number of acres allocated, while prescriptions 3 and 4 were cut in half. Management prescription 1.1 received the 10,000 acres which were constrained to that prescription. As expected by the prescription allocation, the activities and outputs associated with timber production showed several significant changes. LITSY went from 111 MMBF/year to 87 MMBF/year. Hardwood sawtimber was reduced by as much as 403 MMBF in period 2. The effects in sawtimber volume were greatest in the first five decades of the planning horizon. Because of the shift to uneven-aged management, the acres of selection cuts doubled.

This constraint set is responsible for directly removing 151,000 acres, or about 30 percent of the Forest, from the even-aged management prescription. The reason for the large shift in management prescription allocation is due to the increase in the minimum rotation age. By not allowing harvest prior to culmination of mean annual increment of dollars, the amount of acres available for final harvest was greatly reduced. The average age for beginning final harvests is 120 years. This means that only the analysis areas in the 111+ age class can be final harvested in periods 1 and 2. Because of harvest constraints placed in this age class in constraint set 1, only 1/3 of the total acres, or about 1,000 acres, can actually be harvested in periods 1 and 2. Because of this constraint which delays final harvests in prescription 3, the PNV of prescription 2 is more competitive with prescription 3. Therefore, the reduction in volume due to the lack of acres available for final harvest was partially offset by doubling the

acres allocated to uneven-aged management. The analysis areas being allocated to 2 were generally Allegheny and Northern hardwood in the 71 to 110 age classes. The younger age classes and the 111+ were allocated to 3. The reason is the analysis areas in the 71-110 age classes were capable of contributing volume under 2 in periods 1 and 2, when the volume is needed to sustain NDY.

The last constraint (#4) in this alternative addressed the Wilderness problem statement. In this set, as in all previous alternatives, the model was constrained to reflect the PA Wilderness Act legislation. Hickory Creek and the Allegheny River Islands were constrained to a wilderness management prescription and the NRA was constrained to management prescription 6.1. The effect on allocation was to decrease the timber management prescriptions of 2 and 3 by 11,000 and 8,000 acres, respectively. Increases occurred in the allocation of management prescription 5 (9,000 acre increase), 6.1 (7,000 acre increase), and 9.1 (3,000 acre increase). The addition of the wilderness constraint set in Alternative E decreased PNV by \$6 million. Benefit/cost ratio remained unchanged at 5.3. The discounted benefits of recreation and timber were decreased \$2 million and \$11 million, respectively. An increase in discounted benefits of \$4 million in wilderness and \$2 million in wildlife resulted from adding this constraint set. A slight decrease in discounted costs occurred in the wildlife and timber elements. The discounted costs of the wilderness element increased by \$1 million. The Effects on activities and outputs were small. As with all alternatives when this constraint set was added, timber activities and outputs decreased and recreation activities and outputs increased. LSY decreased by 4 MMBF/year. There was a shift from roaded natural to semi-primitive ROS classes. The most significant change was the increase in semi-primitive non-motorized RVD's resulting from the acres constrained to management prescription 5.

TABLE B-92 MANAGEMENT PRESCRIPTION ASSIGNMENTS FROM FORPLAN FOR ALTERNATIVE E
BY CONSTRAINT SET

Management Prescription		Total M Acres Assigned			
		CS1	CS2	CS3	CS4
		Max PNV	BM Timber	Rec/Wldlf	Wild./NRA
Aspen, Grouse	1	0	1	10	10
Uneven-aged, Non-game	2	62	94	186	175
Even-aged, Turkey, Deer	3	388	317	166	158
Even-aged, Softwood	4	19	13	7	7
Wilderness	5	0	0	0	9
Recreation, Wildlife	6.1	29	55	125	132
Even-aged 10 yr. SPM 30 yr.	6.2	1	18	1	1
Wetland Wildlife	6.3	0	0	0	0
Long Rotation Primitive	6.5	0	0	0	0
Developed Recreation	7	0	0	0	0
Special Areas	8	0	0	0	0
Minimum Level	9.1	6	6	8	11

Constraints Within Alternatives

TABLE B-93 ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE E
BY CONSTRAINT SET

ECONOMIC INDICATORS*	CONSTRAINT SETS (CS)			
	CS1 Max PNv BM	CS2 Timber	CS3 Rec/Wldlf	CS4 Wild./NRA
PRESENT NET VALUE (MM\$)	444	429	379	373
CHANGE PNv FROM MAX PNv WITH MMR	-15	-50	- 6	
BENEFIT/COST RATIO	5.3	5.1	5.3	5.3

*Discount rate 4%.

Constraints Within Alternatives

TABLE B-94 ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE E BY ELEMENT

ECONOMIC INDICATORS*	CONSTRAINT SETS (CS)			
	CS1 Max PNV BM	CS2 Timber	CS3 Rec/Wldlf	CS4 Wild./NRA
<u>DISCOUNTED BENEFITS (MM\$)</u>				
<u>Element</u>				
Recreation	157	169	202	200
Wilderness	0	0	0	4
Wildlife	22	23	27	29
Timber	359	335	238	227
OGM	1	1	1	1
Support	1	1	1	1
<u>TOTALS</u>	539	528	469	462
<u>DISCOUNTED COSTS (MM\$)</u>				
<u>Element</u>				
Recreation	8	8	8	8
Wilderness	0	0	0	1
Wildlife	17	15	12	11
Timber	71	75	64	62
OGM	2	2	2	2
Support	3	3	3	3
<u>TOTALS</u>	101	103	89	87

*Discount Rate 4%

Constraints Within Alternatives

TABLE B-95 KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN
FOR ALTERNATIVE E BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)							
	CS1		CS2		CS3		CS4	
	Max PNV M Units	BM M\$	Timber M Units	M\$	Rec/Wldlf M Units	M\$	Wild./NRA M Units	M\$
<u>TIMBER</u>								
LTSY (MBF/Year)	119		111		87		83	
Timber Volume (MBF/Decade)								
Hardwood Sawtimber								
Decade 1	492	64320	361	52875	289	47813	272	45049
2	678	93272	660	70851	257	28569	241	27507
3	715	149055	661	137826	572	110289	543	104681
4	780	164470	777	166100	529	86407	481	82063
5	891	214730	816	195729	658	119008	624	113171
10	510	72898	593	75832	443	65188	426	66849
15	566	87097	662	134109	465	65365	441	62048
Softwood Sawtimber								
Decade 1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
10	1	19	1	7	0	0	0	0
15	98	2782	73	2092	16	212	15	198
Hardwood Pulpwood								
Decade 1	700	0	756	0	581	33	554	33
2	514	0	445	0	613	0	585	0
3	477	0	456	0	298	23	283	22
4	410	0	340	0	341	6	345	6
5	297	0	301	0	212	9	202	9
10	675	0	522	0	427	6	400	6
15	507	0	366	0	367	12	350	12
Softwood Pulpwood								
Decade 1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	2	13	0	0	0	0	0	0
5	4	29	0	0	0	0	0	0
10	6	45	1	14	0	0	0	0
15	21	169	16	147	22	178	20	161

Constraints Within Alternatives

TABLE B-95 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE E BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)							
	CS1		CS2		CS3		CS4	
	Max PNV	BM	Timber		Rec/Wldlf		Wild./NRA	
	M Units	M\$	M Units	M\$	M Units	M\$	M Units	M\$
Total Timber Volume								
Decade 1	1192	64320	1117	52875	870	47848	826	45082
2	1192	93272	1117	70851	870	25869	826	27507
3	1192	149055	1117	137826	870	110312	826	104703
4	1192	164483	1117	166100	870	86413	826	82069
5	1192	214759	1117	195729	870	119017	826	113180
10	1192	72962	1117	75853	870	65613	826	66855
15	1192	90048	1117	136348	870	65767	826	62407
Final Harvest (acres)								
Decade 1		26		4		4		4
2		54		38		1		1
3		35		14		5		5
4		54		50		10		9
5		50		36		11		11
10		43		31		18		17
15		36		33		10		9
Thinnings (acres)								
Decade 1	106		159		38		35	
2	0		21		94		92	
3	84		167		35		33	
4	0		28		75		79	
5	1		36		6		6	
10	48		87		14		12	
15	40		49		45		45	
Selection (acres)								
Decade 1	40		50		113		108	
2	22		39		72		67	
3	40		50		113		108	
4	21		39		72		67	
5	40		50		113		108	
10	21		39		72		67	
15	40		50		114		108	

Constraints Within Alternatives

TABLE B-95 (CON'T) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE E BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)							
	CS1		CS2		CS3		CS4	
	Max PNV M Units	BM M\$	Timber M Units	M\$	Rec/Wldlf M Units	M\$	Wild./NRA M Units	M\$
<u>Herbicide (acres)</u>								
Decade 1	30	1044	23	812	49	1685	46	1601
2	36	1264	35	1240	31	1097	29	1017
3	22	790	13	447	11	391	11	372
4	31	1057	34	1164	11	373	10	337
5	34	1159	26	893	15	534	15	506
10	25	869	22	770	13	450	12	436
15	22	779	24	845	14	501	14	472
<u>RECREATION/WILDLIFE</u>								
<u>SPNM W03 (RVD/Decade)</u>								
Decade 1	0	0	189	1750	16	150	122	1136
2	0	0	216	2008	19	179	184	1709
3	0	0	404	3752	36	331	220	2046
4	0	0	418	3880	38	350	243	2251
5	0	0	251	2330	24	225	239	2219
10	0	0	251	2330	24	225	239	2219
15	0	0	425	3944	39	359	253	2353
<u>SPM W05 (RVD/Decade)</u>								
Decade 1	898	6994	1685	13123	3799	29593	3972	30939
2	920	7165	1727	13450	3893	30325	4070	31702
3	942	7336	1769	13777	3987	31057	4168	32465
4	970	7558	1817	14154	4088	31846	4273	33285
5	980	7644	1838	14318	4135	32212	4322	33667
10	980	7644	1838	14318	4135	32212	4322	33667
15	980	7644	1838	14318	4135	32212	4327	33667
<u>RN W07 (RVD/Decade)</u>								
Decade 1	8632	46614	7906	42692	7556	40805	7187	38812
2	9617	51929	8831	47690	8518	45996	8091	43690
3	10601	57245	9757	52687	9479	51186	8994	48568
4	11651	62916	10748	58037	10506	56731	9963	53798
5	12176	65751	11243	60713	11019	59503	10447	56414
10	12130	65502	11197	60465	10973	59255	10401	56167
15	12130	65502	11197	60465	10973	59255	10401	56167

Constraints Within Alternatives

TABLE B-95 KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN
FOR ALTERNATIVE E BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	CONSTRAINT SETS (CS)							
	CS1		CS2		CS3		CS4	
	Max PNV	BM	Timber		Rec/Wldlf		Wild./NRA	
	M Units	M\$	M Units	M\$	M Units	M\$	M Units	M\$
<u>Big-Game (WFUD/Decade)</u>								
Decade 1	1635	36400	1584	35260	1443	32133	1414	31502
2	1944	43267	1846	41094	1634	36386	1603	35662
3	2007	44680	1932	43017	1634	36382	1608	35790
4	1900	42299	1870	30621	1681	37413	1658	36913
5	1847	41123	1837	40646	1614	35923	1597	35551
10	1835	40853	1722	38328	1499	33366	1490	33159
15	1817	40447	1758	39145	1550	34502	1534	34132

Constraints Within Alternatives

E. Variations on the Preferred Alternative

1. Introduction

After the preferred alternative was selected, it was evaluated in terms of 1) its sensitivity to a first decade budget approximating 80 percent of the current budget, 2) high OGM demand scenario, and 3) its ability for growth to meet 90 percent of LTSY by 2030. Analyzing the effect of a reduced budget required an additional FORPLAN run.

2. Preferred Alternative, Reduced Budget

- a. Purpose: To analyze the sensitivity of the preferred alternative to a first decade budget approximating 80 percent of the FY 1982 appropriation.
 - b. Objective: Evaluate impacts on economic indicators and key activity and outputs resulting from a budget lower than recent funding level.
 - c. Constraint Sets
 - Include all constraints in Section VII.C. Alternative D.
 - Budget Limit
 - Constraint: A budget constraint limiting the first decade total FORPLAN costs to a maximum of \$24.24 million was imposed.
 - Rationale: FY 1982 budget was used in this run because costs and returns used in the FORPLAN model were based on FY 1982 data. By using FY 1982 budget, it ensures consistency between the budget constraint and the data set. Based on the 1982 fiscal obligated fund summary, total costs minus carry over dollars and payments to counties, \$9.81 million was spent. Total costs discounted to 1978 dollars equals \$7.04 million. Eighty percent of \$7.04 million times 43 percent (cost in FORPLAN) equals \$2.424 million per yer or \$24.24 million per decade.
 - d. Results
-

Tables B-96 to B-99 compare the reduced budget run to Alternative D. Table B-96 displays the management prescription assignment of the two runs. Table B-97 compares the PNV and B/C ratio between Alternative D and the reduced budget run. Table B-98 provides discounted benefits and costs by elements for the runs. Finally, Table B-99 displays the differences between key activities and outputs of Alternative D and the 80 percent budget run.

No changes occur in the prescription allocation of the reduced budget run, obviously due to the constraint on the allocation in Alternative D.

Tables B-97 and B-98, which provide economic indicators comparing the reduced budget run to Alternative D, show a \$14 million decrease in the PNV of the reduced budget run. However, the benefit/cost ratio increases from 5.9 to 6.8. The increase is a result of the marginal decrease in discounted costs being greater than the marginal decrease in discounted benefits when the reduced budget run is compared to Alternative D.

The discounted benefits displayed in Table B-98 indicate a drop in discounted benefits in the reduced budget run of \$28 million over Alternative D. The decrease in discounted benefits is spread across two elements with decreases of \$1 million in recreation and \$27 million in the timber element.

The \$1 million reduction in the recreation element results from some of the acres in management prescription 6.1 shifting from high recreation intensity to medium recreation intensity. In order to meet the budget constraint, 16,000 acres of the 124,000 acres in management prescription shifted from the high to medium recreation intensity under the reduced budget run.

The reduction in the timber element was because timber volume went from 347 MMBF in Alternative D to 310 MMBF in the reduced budget run in decade 1. The original constraint in the reduced budget run was 347 MMBF in decade 1, the same as Alternative D. Because of the budget constraint, this constraint was loosened to 310 MMBF to get a feasible solution.

The discounted costs section of Table B-98 shows a reduction of \$14 million in discounted costs for the reduced budget run with the entire \$14 million coming

from the timber element. In order to meet the budget requirement, which is constraining in the run, the model is forced to pick less costly methods of harvesting timber which have a lower PNV but meet the budget constraint.

Examining the activity/output chart (Table B-99), it becomes apparent that a major reduction in thinning prescriptions occurred. Thinnings in period 1 are reduced by 34,000 acres or 39 percent in the reduced budget run. There is also a constraint of 30,000 acres of final harvest, which is binding. Without releasing this constraint, the more costly thinning prescriptions, which were dropped from solution due to the budget constraint, could not be replaced by final harvest prescriptions. The result are reductions in LTSY of 11 MMBF/year, total volume of 110 MMBF in decade 1, and sawtimber volume of 37 MMBF in the first decade.

There are no significant changes in the reduced budget run in outputs in the recreation and wildlife elements. A slight reduction in semi-primitive motorized RVD's occurred as a result of the 16,000 acre shift from high to medium recreation opportunity intensity in management prescription 6.1.

3. Preferred Alternative, High OGM Demand

- a. Purpose: To analyze the sensitivity of the preferred alternative to OGM development on ANF at 1980 to 1982 levels. For additional information on the high OGM demand scenario, see Section IV.B.
- b. Objective: Identify and discuss the effects on economic indicators and key activities and outputs as a result of a high levels of OGM activity on the ANF.
- c. Constraint Sets
 - Include all constraints in Section III.C. Alternative D.
 - High OGM Demand Scenario
 - Constraint: Require 189,000 acres to receive a high OGM prescription
 - Rationale: In the development of alternatives, the low OGM demand estimates were used. This decision was a result of

the benchmark analysis which indicated the high OGM demand scenario would have a greater effect on the allocation of prescriptions than the low OGM demand. The Management Team then decided due to high risk and uncertainty of OGM development, the allocation should not be based on a high level of OGM development which is not controlled by the Forest. They decided we should test the sensitivity of the preferred alternative to high OGM demand. Under low OGM demand 65,000 acres are allocated to a high OGM prescription, while under high OGM demand 189,000 acres are allocated.

d. Results

As in the reduced budget run, Tables B-96 to B-99 compare the high OGM demand run to the preferred alternative (Alternative D). Table B-96 displays the management prescription assignment. Table B-97 compares the PNV and B/C ratio of Alternative D and the high OGM demand run. Table B-98 displays discounted benefits and costs by elements for the runs. Table B-99 provides a comparison of selected activities and outputs of Alternative D and the high OGM run.

There was no change in prescription assignments since the high OGM run was required to have the same number of acres in each management prescription as the low OGM run.

The economic indicators in Tables B-97 and B-98 show a present net value drop of \$46 million when the high OGM run is compared to Alternative D. The benefit/cost ratio goes from 5.9 to 5.2. These changes are a result of a \$43 million decrease in discounted benefits a \$3 million increase in discounted costs.

The display of discounted benefits by element in Table B-98 indicates large decreases of \$21 million and \$30 million in the recreation and timber elements, respectively. The reason for the decrease in the recreation element is because the OGM prescriptions place significantly less emphasis on recreation. No trails are built and little emphasis is placed on dispersed recreation. As a result, the number of RVD's produced are low when compared to the low OGM prescriptions. Most of the decrease in recreation is

Variations on the Preferred Alternatives

due to the shift of acres for these 3 medium recreation/wildlife intensity to the 3 high OGM prescription.

The decrease in the timber element occurs for two reasons. The first is because increased OGM development takes land out of timber production. The timber removed from OGM clearings shows a benefit in the OGM element instead of the timber element (the reason for the \$10 million increase in discounted benefits in the OGM element). The clearings also reduce the per acre yields for land remaining in timber management within OGM developments.

As indicated earlier, discounted costs increase by \$3 million in total. An increase in discounted costs of \$9 million occurred in the OGM element. This was partially offset by the decrease in discounted costs of \$1 million, \$2 million, and \$3 million in the recreation, wildlife, and timber elements, respectively. The decrease in the recreation and wildlife elements results from the lower emphasis placed on these elements in the OGM subgoal. The decrease in the timber element cost results primarily from decreased road building; OGM developers build many of them. The increase in discounted costs of the OGM element results from the increased development activity.

Table B-99 is a summary of key activities and outputs for the Alternative D and the high OGM run. A decrease in LTSY of 4 MMBF/year occurred in the high OGM run. There was a slight reduction in hardwood sawtimber volume, a result of acres taken out of production. The only significant change in RVD's occurred in the roaded natural category, where RVD's in the high OGM run decreased by approximately 19 percent over the preferred alternative. This results from a reduced emphasis on recreation and wildlife in the high OGM prescriptions.

4. Analysis of Growth Requirements in the Preferred Alternative

In the preferred alternative, growth reaches 90 percent of LTSY by 2030. The following decade (decade 6) growth drops below 90 percent to 76 percent. After decade 6, growth rises to above 90 percent of LTSY for the remainder of the planning horizon. Since growth reaches 90 percent of LTSY by 2030, a departure is not necessary for this reason.

TABLE B-96 MANAGEMENT PRESCRIPTION ASSIGNMENTS FROM FORPLAN FOR ALTERNATIVE D BY CONSTRAINT SET

Management Prescription		Total M Acres Assigned		
		Alt. D	80% Budget	High OGM Demand
Aspen, Grouse	1	7	7	7
Uneven-aged, Non-game	2	6	6	6
Even-aged, Turkey, Deer	3	327	327	327
Even-aged, Softwood	4	0	0	0
Wilderness	5	10	10	10
Recreation, Wildlife	6.1	124	124	124
Even-aged 10 yr. SPNM 30 yr.	6.2	20	20	20
Wetland Wildlife	6.3	0	0	0
Long Rotation Primitive	6.5	0	0	0
Developed Recreation	7	0	0	0
Special Areas	8	0	0	0
Minimum Level	9.1	9	9	9

Variations on the Preferred Alternative

TABLE B-97 ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE D
BY CONSTRAINT SET

<u>ECONOMIC INDICATORS*</u>	<u>Alt. D</u>	<u>80% Budget</u>	<u>High OGM Demand</u>
PRESENT NET VALUE (MM\$)	384	370	338
CHANGE PNV FROM MAX PNV WITH MMR	-14	-46	
BENEFIT/COST RATIO	5.9	6.8	5.2

*Discount rate 4%.

Variations on the Preferred Alternative

TABLE B-98 ECONOMIC INDICATORS FROM FORPLAN FOR ALTERNATIVE D BY ELEMENT

<u>ECONOMIC INDICATORS*</u>	<u>Alt. D</u>	<u>80% Budget</u>	<u>High OGM Demand</u>
<u>DISCOUNTED BENEFITS (MM\$)</u>			
<u>Element</u>			
<u>Recreation</u>	156	155	135
<u>Wilderness</u>	4	4	4
<u>Wildlife</u>	26	26	24
<u>Timber</u>	274	247	244
<u>OGM</u>	1	1	11
<u>Support</u>	<u>1</u>	<u>1</u>	<u>1</u>
<u>TOTALS</u>	462	434	419

DISCOUNTED COSTS (MM\$)

<u>Element</u>			
<u>Recreation</u>	5	5	4
<u>Wilderness</u>	1	1	1
<u>Wildlife</u>	10	10	8
<u>Timber</u>	57	43	54
<u>OGM</u>	2	2	11
<u>Support</u>	<u>3</u>	<u>3</u>	<u>3</u>
<u>TOTALS</u>	78	64	81

Discount Rate 4%

Variations on the Preferred Alternative

TABLE B-99 KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN
FOR ALTERNATIVE D BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	Alt. D		80% Budget		High OGM Demand	
	M Units	M\$	M Units	M\$	M Units	M\$
<u>TIMBER</u>						
<u>LTSY (MBF/Year)</u>	89		78		85	
<u>Timber Volume (MBF/Decade)</u>						
Hardwood Sawtimber						
Decade 1	347	50677	310	39029	334	47517
2	426	56451	373	53501	353	48525
3	541	115692	445	91873	473	89812
4	555	121698	487	105594	530	113846
5	617	128325	537	123868	587	120287
10	486	90144	490	82641	447	80029
15	491	93272	464	99331	490	96186
Softwood Sawtimber						
Decade 1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
10	0	0	0	0	0	0
15	0	0	0	0	0	0
Hardwood Pulpwood						
Decade 1	539	0	466	25	512	0
2	460	7	403	0	493	12
3	345	1	331	9	373	13
4	331	0	289	4	316	0
5	269	0	239	8	259	0
10	400	4	286	4	399	7
15	395	0	312	5	356	7
Softwood Pulpwood						
Decade 1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
10	0	0	0	0	0	0
15	0	0	0	0	0	0

Variations on the Preferred Alternative

Table B-99 (con't) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE D BY CONSTRAINT SET

ACTIVITY/OUTPUT BY PROBLEM STATEMENT	<u>Alt. D</u>		<u>80% Budget</u>		<u>High OGM Demand</u>	
	M Units	M\$	M Units	M\$	M Units	M\$
<u>Total Timber Volume</u>						
Decade 1	886	50677	776	39054	846	47517
2	886	56458	776	53501	846	48537
3	886	115693	776	91882	846	89825
4	886	121698	776	105598	846	113846
5	886	128325	776	123876	846	120287
10	886	90148	776	82645	846	80029
15	886	93272	776	99336	846	96193
<u>Final Harvest (acres)</u>						
Decade 1	30		30		30	
2	31		30		24	
3	44		35		35	
4	28		29		30	
5	37		30		34	
10	38		33		32	
15	40		31		36	
<u>Thinnings (acres)</u>						
Decade 1	87		53		88	
2	71		43		97	
3	18		29		55	
4	70		48		79	
5	19		16		35	
10	42		23		49	
15	1		5		22	
<u>Selection (acres)</u>						
Decade 1	7		7		7	
2	0		0		0	
3	7		7		7	
4	0		0		0	
5	7		7		7	
10	0		0		0	
15	7		7		7	
<u>Herbicide (acres)</u>						
Decade 1	18	612	18	615	18	607
2	16	564	16	538	13	446
3	26	904	19	643	20	685
4	14	478	14	494	17	570
5	20	700	16	551	19	573
10	21	724	17	599	16	563
15	22	753	16	572	20	678

Variations on the Preferred Alternative

Table B-99 (con't) KEY ACTIVITY/OUTPUT AND BUDGET/RECEIPT SUMMARY FROM FORPLAN FOR ALTERNATIVE D BY CONSTRAINT SET

RECREATION/WILDLIFE

SPNM W03 (RVD/Decade)

Decade 1	296	2757	283	2628	296	2734
2	417	3870	397	3683	411	3816
3	658	6101	621	5757	648	6008
4	732	6816	689	6399	718	6672
5	605	5610	570	5289	590	5478
10	605	5620	570	5289	590	5478
15	771	7148	725	6751	755	7008

SPM W05 (RVD/Decade)

Decade 1	3678	28653	3671	28594	3552	27669
2	3723	29004	3716	28945	3597	28020
3	3768	29354	3761	29295	3642	28370
4	3820	29761	3813	29704	2694	28777
5	3842	30201	3835	29876	3716	28949
10	3842	30201	3835	29876	3716	28949
15	3842	30201	3835	29876	3716	28949

RN W07 (RVD/Decade)

Decade 1	4994	26968	5006	27033	4064	21945
2	5246	28331	5248	28340	4060	21926
3	5499	29694	5490	29647	4057	21907
4	5817	31409	5801	31326	4240	22898
5	5975	32267	5957	32166	4332	23394
10	5930	32020	5908	31905	4201	22687
15	5930	32020	5908	31905	4201	22687

Big-Game (WFUD/Decade)

Decade 1	1471	32753	1469	32709	1306	29075
2	1621	36069	1622	36085	1427	31760
3	1685	35715	1684	37482	1460	32497
4	1744	38817	1729	38477	1510	33620
5	1706	37964	1719	38276	1509	33598
10	1684	37982	1672	37231	1481	32957
15	1707	37999	1726	38426	1449	32245

Variations on the Preferred Alternative