

■ Appendix B

**FORPLAN
Resource Allocation Model
and Analysis Process**

APPENDIX B. THE RESOURCE ALLOCATION MODEL AND ANALYSIS PROCESS

INTRODUCTION

The purpose of this Appendix is to present a technical discussion of the analysis process and models used. Basic assumptions, model components and inputs, modeling rules and methods, and modeling constraints imposed (along with their rationale and impacts) are described. Information presented supplements the broader and less technical descriptions that are included in the body of the DEIS.

Because of the complexity of the planning process, the large variety of land units, and the possible management activities that could be applied, a number of mathematical models were needed to conduct the analysis.

FORPLAN is the primary modeling tool used to assure that land allocations and output schedules for alternatives and benchmarks are made in a way that meets all constraints in the most cost efficient manner. In addition to being used to formulate alternatives and benchmarks that are both feasible and cost efficient, FORPLAN is also used to perform detailed accounting work and to generate summary reports of information needed to construct the display tables in the EIS. Additional models are used to generate input data for use in FORPLAN and to interpret output data from FORPLAN. RAMPREP is the growth and harvest model used to make timber yield estimates for use in FORPLAN. The FIREPLAN system was used to estimate the fire organization, activity levels, and fire management costs required to efficiently achieve the program direction for each alternative. Wildlife Habitat Capability Models were used to estimate effects on wildlife and fish populations. An income and employment model was built using the RIMS system in order to estimate income and employment effects from changes in Forest outputs. A more detailed description of each of these models is included in this appendix.

THE FOREST PLANNING MODEL (FORPLAN) 1/

Overview

FORPLAN is a specialized matrix generator and report writer for a standard linear programming algorithm (FMPS) 2/. Linear programming is a mathematical technique for solving simultaneous linear equations subject to a certain set of constraints and a particular objective function.

1/ See Johnson, K. Norman; Daniel B. Jones, and Brian M. Kent; Forest Planning Model (FORPLAN) User's Guide and Operations Manual, USDA Forest Service, May 1980.

2/ FMPS = Acronym for functional math program subsystem, the linear program code used on the Univac 1100 series computer.

This is expressed mathematically as:

$$\text{Maximize: } z = c_1x_1 + c_2x_2 + \dots + c_nx_n \quad (\text{Objective function})$$

$$\text{Subject to: } a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n \leq b_1$$

$$a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n \leq b_2 \quad (\text{Constraint Set})$$

$$a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n \leq b_m$$

$$x_i \geq 0$$

These mathematical expressions can also be shown as in the following matrix:

	Column j=1	Column j=2	Column j=3	Column j=n	Con- straint Type	Right Hand Side Con- straint
Objective function	C_1x_1	C_2x_2	C_3x_3	C_nx_n		Maximize
Row i = 1 (Timber)	$a_{11}x_1$	$a_{12}x_2$	$a_{13}x_3$	$a_{1n}x_n$	\geq	b_1
Row i = 2 (Acres)	$a_{21}x_1$	$a_{22}x_2$	$a_{23}x_3$	$a_{2n}x_n$	\leq	b_2
Row i = m	$a_{m1}x_1$	$a_{m2}x_2$	$a_{m3}x_3$	$a_{mn}x_n$	=	b_m
				x_j	\geq	0

In the FORPLAN formulation, the linear equations (rows) represent resource production functions, costs, and acreage or other types of constraints (for example, row 1 might represent timber production; row 2 might represent total acres; row m might represent recreation). The columns $j = 1$ to n represent the different activities (prescriptions) which can occur over time on specific units of land called analysis areas (represented by x_j). The a_{ij} 's in the matrix are the production, cost, or resource coefficients associated with each prescription/analysis area combination. The b_i 's are the right-hand-side values representing exact amounts (=) or upper (<) or lower (>) constraint levels that must be met. In the example above, if row 1 represents timber production, the interpretation of the constraint:

$$a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + \dots + a_{1n}x_n \geq b_1$$

would be the total amount of timber produced from all prescriptions and analysis areas must be greater than or equal to the amount b_1 .

The FORPLAN model was built by representing the production functions, costs, values, and resource supplies for the Forest in the mathematical format described above. For the Inyo National Forest, the resulting model contained approximately 13,305 columns and 2,219 rows. Once the model was formulated, test runs were made to check the model for reasonableness and to make

additional calibrations. Land allocations, activity and output schedules, costs, benefits, and present net value were developed by altering the objective function and constraint set to meet the theme of each alternative and benchmark, and then running the model.

Unique constraint sets were developed to represent minimum management requirements, minimum implementation requirements, Forest discretionary constraints common to all alternatives, and specific land allocations and output schedules needed for individual alternatives.

An iterative process was used to formulate these constraint sets prior to making final FORPLAN runs for the alternatives and benchmarks (see following sections of this appendix).

FORPLAN was used to determine the most cost-efficient mix of goods and services that could be produced from the Forest given the objectives and constraints of each alternative. The trade-offs made among alternatives were examined and the costs and benefits associated with each objective or constraint measured. This analysis provided a way of indirectly evaluating non-priced benefits by measuring the amount of present net value (PNV) foregone. The final criterion used to evaluate alternatives was net public benefit (NPB), which is the PNV plus consideration of nonpriced Forest resource benefits.

Management activities modeled in FORPLAN were determined by the interdisciplinary (ID) team. This pre-FORPLAN analysis included identifying:

1. The activities that could be applied to National Forest system land.
2. Those activities that could be modeled in FORPLAN.
3. The kinds of land to which each activity could be applied.
4. The costs, outputs, and benefits which would result from the application of each activity to a specific type of land.
5. The compatibility of activities when applied to the same land area.

This provided the basis for a matrix of all possible management activities which could be modeled and their associated costs, outputs, and effects.

Activities which were desired but not modeled as one of the above FORPLAN inputs required the use of additional constraints.

Land Units

Capability Areas are the smallest unit of land (or water) used in Forest planning. They are discrete and recognizable units classified primarily according to physical (e.g. soil, watershed), biological (e.g. vegetation), and administrative (e.g. county lines, Forest boundary) factors. All land within a capability area is homogeneous in its ability to produce resource outputs and in its production limitations. The Forest has 9,400 Capability Areas.

Capability Areas were developed by overlaying existing map information. (See Table 1 for examples of the type of map information used.) The Wildland Resource Information System (WRIS) was used to calculate capability area

acreages and to number each area for identification in the data base (Forest Planning File). The interdisciplinary team decided what information was needed for each capability area to assess resource opportunities and public issues and then collected that information about each area. Different resource attributes were determined for each capability area. This information was entered into a computerized data base system (Intel's System 2000). Once entered into the system, information on Capability Areas could be retrieved, sorted, aggregated, and analyzed.

Because of their large number, individual Capability Areas could not be used in FORPLAN. Use of such a large number of land units would be cumbersome, expensive, and would have exceeded the matrix size limits that can be utilized in FORPLAN. Analysis areas were created to handle this problem. Analysis areas are an aggregation of like Capability Areas with sufficiently similar physical, biological, and administrative conditions that would probably respond in a like manner to management activities. Each capability area was given an analysis area identifier so the data base could be queried for the land information needed to build the FORPLAN model.

The delineation of the analysis areas required several steps. First, resource specialists on the interdisciplinary team decided which physical or biological attributes in the data base were necessary to determine their resource yields. The selection of which resource outputs to monitor in FORPLAN was guided by the problems identified by the Forest issues, concerns, and opportunities.

Next, the analysis areas were defined using each attribute proposed by the resource specialists as a level of stratification, or level identifier in FORPLAN. Because FORPLAN could accommodate only six level identifiers, the number of attributes initially selected by the resource specialists was greater than could be used. This forced the interdisciplinary team to select the most critical attributes necessary to address the planning problems and to consider the reliability of the data for making yield and cost estimates.

The attributes finally chosen were roaded status, potential ski areas, vegetation and special land groups, slope, and vegetation strata (species, size classes, and stocking). It should be noted that roaded status was selected as a level identifier, both to introduce the important costs of developing access for resource management, and to allow tracking of possible yields from each of the California Wilderness Act roadless areas on the Forest. The other level identifiers are necessary to analyze the biological production potential of an analysis area.

The criteria used to develop analysis areas are the level identifiers in FORPLAN. The level identifiers used are shown in Figure B-1. Data reliability and the need to respond to issues related to specific geographic areas (recreation zones, further planning areas, etc.) played a major role in the delineation of analysis areas. In many cases, the data reliability for Capability Areas was such that large numbers of Capability Areas were aggregated into individual analysis areas. The need to maintain the geographic identity of some individual Capability Areas limited the amount of aggregation that could occur. The Inyo's data base has a total of 300 analysis areas based on actual National Forest System acres and 4 analysis areas not representing real acres. Analysis areas that do not represent

actual land area, represent instead developed and dispersed recreation facilities, or program levels such as fire management.

Table 1
Level Identifiers Used in FORPLAN

Level 1

CONC	CONCENTRATED RECREATION AREAS	047	SAN JOAQUIN
OPENNF	OPEN NATIONAL FOREST LANDS	048	GRANT LAKE
OTHOWN	LANDS IN OTHER OWNERSHIP	049	HORSE MEADOW
SKI	EXISTING SKI AREAS	050	TIOGA LAKE
SPEC	SPECIAL INTEREST AREAS	051	HALL NATURAL AREA
	(RNAs, ETC.)	052	LOG CABIN SADDLEBAG
WILD	EXISTING WILDERNESS	053	DEXTER CANYON
029	SOUTH SIERRA	054	GLASS MOUNTAIN
030	WONOGA PEAK	055	WATTERSON
031	INDEPENDENCE CREEK	056	BENTON RANGE
032	TINEMAHA	057	DEEP WELLS
033	COYOTE SOUTHEAST	058	WHITE MOUNTAINS
034	COYOTE NORTH	059	BLANCO MOUNTAIN
035	TABLE MOUNTAIN	060	BIRCH CREEK
036	NORTH LAKE	061	BLACK CANYON
038	BUTTERMILK	062	SOLDIER CANYON
039	HORTON CREEK	063	ANDREWS MOUNTAIN
040	WHEELER RIDGE	064	PAIUTE
041	NESSIE	288	MONO CRATERS
042	ROCK CREEK WEST	296	SUGARLOAF
043	WHISKY CREEK	988	MT. OLSEN
044	NEVAHBE RIDGE	989	EXCELSIOR
045	LAUREL MCGEE	MONOLK	MONO BASIN NFSA
046	SHERWIN	WESTSD	WESTSIDE HYW. 395

Level 2

ALPOT ALPINE SKI AREA POTENTIAL

Level 3 (not used)

Level 4

BARWAT	BARREN OR WATER	PLNTAT	PLANTATION
MXBRSH	MIXED BRUSH	OTHOWN	LANDS IN OTHER OWNERSHIP
NONCOM	NONCOMMERCIAL TIMBER		
PINYON	PINYON-JUNIPER	SPEC	SPECIAL INTEREST AREAS
SUBRSH	SUITABLE BRUSH		
SUTIMBR	SUITABLE TIMBER	WILD	EXISTING WILDERNESS

Level 5

0-30% SLOPE	61+
31-60	ALL SLOPES

Table 1 (continued)
Level Identifiers Used in FORPLAN

Level 6

BBR2A	BITTERBRUSH
BSG2A	BIG SAGEBRUSH
CMG2A	MOUNTAIN MAHOGANY
PLANTAT	PLANTATION
L3P	LODGEPOLE, MEDIUM SAWTIMBER, POOR STOCKING
P2P	JEFFREY PINE, SMALL POLE & SAWTIMBER, POOR STOCKING
P2S	JEFFREY PINE, SMALL SAWTIMBER, SPARSE STOCKING
P2G	JEFFREY PINE, SMALL SAWTIMBER, GOOD STOCKING
P4P	JEFFREY PINE, MED-LARGE SAWTIMBER, POOR STOCKING
P4S	JEFFREY PINE, MED-LARGE SAWTIMBER, SPARSE STOCKING
P6G	JEFFREY PINE, TWO-STORIED STANDS, GOOD STOCKING
R4X	MIXED CONIFER, MED-LARGE SAWTIMBER, VARIABLE STOCKING
R6G	RED FIR, TWO-STORIED, GOOD STOCKING

Management areas are delineated based on geopolitical factors (such as administrative boundaries, issue orientation, historical use patterns, access, landform, and vegetation type) and are used to facilitate administration or plan implementation. Management areas are delineated on a map accompanying the Plan.

It is easier for a land manager to deal with specific geographical areas, such as watersheds, than with prescriptions that may be assigned to many different locations. Often, geographic areas will have unique issues and concerns, even though the assigned prescriptions may be the same as its neighbors. Therefore, the Forest was divided into twenty Management Areas, which are contiguous lands in some identifiable geographic location, such as the White Mountains.

Prescriptions

A prescription is a set of management practices and the schedule for their application on a specific area to achieve desired objectives. For a given analysis area, the range of prescriptions describe what could be done (i.e., the possibilities) on that analysis area. FORPLAN is used to determine what should be done given the constraints and objective function for an alternative.

Management distinguishes between FORPLAN prescriptions and Management Prescriptions. FORPLAN prescriptions are sets of activities which could occur on the analysis areas that are modeled in FORPLAN. They are specific activities that are written without imposition of the standards and guidelines. Management Prescriptions are written as a result of delineating objectives of an alternative, or allocating specific land areas to FORPLAN prescriptions and imposing the standards and guidelines. The management prescription includes the FORPLAN prescription as one of its parts, but is broadened to include additional practices and direction needed to meet

standards and guidelines and to be comprehensive of all resource activities for field implementation.

FORPLAN prescriptions were developed by the interdisciplinary team to respond to issues and to represent the range of management opportunities. They were developed to represent five general conditions or levels of management intensity: minimum level of management, management below current levels, current level of management, management at a greater intensity than current management, and management at the maximum intensity level that is implementable. Past experience and cost data were used to determine the most cost efficient mix of practices to achieve the objectives at each level of management intensity.

These prescriptions were quantified in terms of the outputs, costs, and benefits that would occur when the prescription is applied to a given analysis area or land unit. This quantification process produced the output, cost, and benefit coefficients that are used in the FORPLAN yield and economic tables.

FORPLAN prescriptions were developed to allow consideration of a full range of management activities on the analysis areas (see Table 2). A minimum level prescription was created for each analysis area to allow a choice between selecting the possible intensive practices or selecting no active management practice. The choice of prescriptions identified for each analysis area was constrained only by technical feasibility. Limiting the prescription choices available for consideration is one type of constraint which was used to formulate alternatives and benchmarks. See Table 3 for a comparison of FORPLAN and Management Prescriptions, including prescriptions that are available for different categories of analysis areas.

The following is a brief description of the Forest's FORPLAN prescriptions (including their alphabetical codes).

Table 2
Summary Description of FORPLAN Prescriptions

MINLVL	Minlevel applies minimum custodial direction for all resources to all analysis areas. For the most part, only background outputs occur. There are no associated developed recreation, range, or timber outputs. The fire program is maintained at a level needed to protect public safety from the threat of fires originating on National Forest land.
CCW/O	Clearcut is the removal of all merchantable commercial trees within a stand, without any thinnings prior to that clearcut. The objective of this method is to establish a new, fully-stocked stand.
SHW/O	Shelterwood without any thinnings prior to that shelterwood. Shelterwood is cutting all but 8 to 12 overstory trees per acre and planting. The overstory trees are removed the next decade.

Table 2 (continued)
Summary Description of FORPLAN Prescriptions

CCW/TH	Same as CCW/O, except growing stock above desired levels may be thinned each decade.
SHW/TH	Same as SHW/O, except growing stock above desired levels may be thinned.
OVRREM	Removal of overstory from a two-storied stand, followed by management as CCW/TH or SHW/TH,
UNEVEN	Same as CCW/O and CCW/TH, except opening are limited to 3 to 5 acres, at least 3 age classes with 20 years between age classes in the stand and 80 to 140 acres in a managed uneven aged stand.
SALVAG	Salvage. Occasional removal of scattered dying trees. Does not include large fire or insect salvage sales.
STANDM	Stand maintenance. Stand management guided by a resource other than timber.
HMPIBB	High range development with high utilization includes: one-mile pipe and trough, 4-mile fence, rejuvenate and seed 1.5 percent per year, and livestock utilize 60 percent of annual forage production on 500-acre unit of bitterbrush.
HWPIBB	High range development with moderate utilization includes: one-mile pipe and trough, 4-mile fence, rejuvenate and seed 1.5 percent per year, and livestock utilize 50 percent of annual forage production on 500-acre unit of bitterbrush.
MEPIBB	Moderate range development with lower utilization includes: one-mile pipe and trough, 4-mile fence, rejuvenate and seed 1.0 percent per year, and livestock utilize 40 percent of annual forage production on 2,000-acre unit of bitterbrush.
HMPIBS	High range development with high utilization includes: one-mile pipe and trough, 4-mile fence, type convert and seed 10 percent per year, and livestock utilize 60 percent of annual forage production on 500-acre unit of big sage, non-commercial timber, non-suitable timber or pinyon.
HWPIBS	High range development with moderate utilization is the same as HMPIBS, except livestock utilize 50 percent of annual forage production.
EXMTBB	Maintain existing structures in bitterbrush.
EXMTBS	Maintain existing structures in big sage.
EXMTPN	Maintain existing structures in pinyon and non-commercial timber.

Table 2 (continued)
Summary Description of FORPLAN Prescriptions

EKMTOT	Maintain existing structures in other than above-mentioned lands.
BRRELW	Brush release on winter deer range to rejuvenate brush to an earlier seral stage. Brush rejuvenation would take place through one of several methods using either herbicides, prescribed fire, or mechanical equipment as appropriate.
BRRELS	Brush release on summer deer range to rejuvenate brush to an earlier seral stage. Brush rejuvenation would take place through one of several methods using either herbicides, prescribed fire, or mechanical equipment as is appropriate.
LSTFLOW	The low intensity stream prescription applied to streams that have a low quality fish habitat rating. Activities include planting and seeding of streambanks, and fencing to protect streambanks and riparian vegetation from grazing.
LSTMOD	The low intensity stream prescription applied to streams that have a moderate quality fish habitat rating. Activities include planting and seeding of streambanks, and fencing to protect streambanks and riparian vegetation from grazing.
MSTFLOW	The moderate intensity stream prescription applied to streams that have a low quality fish habitat rating. Activities include planting and seeding of streambanks and fencing to protect streambanks and riparian vegetation from grazing. Additionally, instream structures are used to improve the fish habitat.
MSTMOD	The moderate intensity stream prescription applied to streams that have a moderate quality fish habitat rating. Activities include planting and seeding of streambanks and fencing to protect streambanks and riparian vegetation from grazing. Additionally, instream structures are used to improve the fish habitat.
HSTFLOW	The high intensity stream prescription applied to streams that have a low quality fish habitat rating. Activities include planting and seeding of streambanks and fencing to protect streambanks and riparian vegetation from grazing. Additionally, streambank armoring is used to protect or enhance streambank stability.
HSTMOD	The high intensity stream prescription applied to streams that have a moderate quality fish habitat rating. Activities include planting and seeding of streambanks and fencing to protect streambanks and riparian vegetation from grazing. Additionally, streambank armoring is used to protect or enhance streambank stability.

Table 2 (continued)
Summary Description of FORPLAN Prescriptions

WATDEV	The water development prescription includes both structures and/or protective measures to ensure water within an area where it is limited or unavailable for use. Two types of activities are included: spring development or design and construction of guzzlers and catchments.
FENCE	This activity includes all types of fencing (drift, standard, electric, etc.) to protect an area (usually a wet meadow). Usually refers to exclusion of cattle.
WEIMDM	The watershed activity which includes rock armoring of headcuts and streambanks, planting willows along streams, and seeding grasses and legumes.
WEIMDH	This activity provides rock armoring of headcuts and streambanks, willow plantings along streams, seeding grasses and legumes, and placement of gully plugs.
WEIMDF	This activity involves rock armoring of headcuts and streambanks and fencing meadows to control livestock use.
DEVSTD	<p><u>Public Standard.</u> Developed recreation at standards includes the administration, operation, and maintenance of sites and areas to full standard management objectives. Site facilities are maintained in a satisfactory condition to meet standards and objectives for public health, safety, comfort, and convenience. Facilities are maintained to RIM Condition Class I.</p> <p><u>Private Standard.</u> The administration of recreation-related permitted use of National Forest lands. Includes permits granted to other public organizations or private permittees and sites and facilities owned by the Forest Service, but operated by others under permit or agreement. Sites and facilities are operated and maintained to the full terms of the permit for health, safety, comfort, and convenience of the user.</p>
DEVLOW	Developed recreation at low standard includes administration, operation, and maintenance of sites and areas at low standard management levels. Public health and safety and site protection requirements are met, but desired standards and objectives for visitor comfort and convenience are not met.
DEVHAB	Rehabilitation of developed sites includes feasibility studies and project plans for rehabilitation to return sites to designed capacity. Includes rehabilitation of sites and facilities that do not meet present standards. Facilities in RIM Condition Classes 2-5 are upgraded to Condition Class 1. Resource treatment and site protection are also accomplished. Capacity of sites does not increase.

Table 2
Summary Description of FORPLAN Prescriptions

DEVCON	<p><u>Public Construction.</u> Construction of developed sites includes developing plans, specifications, and a contract package along with construction of new recreation sites (including all developed site facilities in the design). The newly developed site or addition to an existing site provide additional capacity.</p> <p><u>Private Construction.</u> Development of a prospectus and plans, and issuance of a permit for construction of a privately developed facility. The newly developed site or addition to an existing site provide additional capacity.</p> <p>(Developed recreation capacity was based on types of existing and potential developed sites, as shown in the current recreation inventory data and projection of this use.)</p>
SHEDWN	The elimination of developed recreation areas and all facilities and improvements, including restoration of on-site resources to meet public safety and site-protection requirements. This action results in a reduction of capacity.
DISSTD	Standard level of dispersed recreation management includes maintaining roads and trails at assigned standards for public safety and resource protection. Use can approach design capacities and provide a safe and quality recreational experience.
DISLOW	Dispersed recreation management at low standard includes maintaining roads and trails at basic custodial levels to protect investments and minimize damage to adjacent land and resources. Facility capacity and use can be expected to be at less than design capacity. Meets standards for public safety, but not for user comfort and convenience.
DISCON	Dispersed recreation construction includes planning, design, and construction of new trailheads and trails. The facilities are to be permanent, and construction and maintenance are to be at full design standards. An increase in RVDs and capacity can be expected.
DISHAB	Dispersed recreation rehabilitation includes the reconstruction of existing roads and trails to original design standards, and when maintained at this level, to provide full public safety, comfort, convenience, and protection of adjacent land and resources. Use may increase to designed capacity.
CURCUR	The current fire program at current funding represents the existing (1982) percentage combination of suppression, detection, and prevention in the fire program at current funding levels.

Table 2 (continued)
Summary Description of FORPLAN Prescriptions

CUR-40	The current fire program at minus-40-percent funding represents existing percentage combination of suppression, detection, and prevention in the fire program with a 40-percent across-the-board reduction in funding.
CUR-20	The current fire program at minus-20-percent funding represents existing percentage combination of suppression, detection, and prevention in the fire program with a 20-percent across-the-board reduction in funding.
CUR+20	The current fire program at plus-20-percent funding represents existing percentage combination of suppression, detection, and prevention in the fire program with a 20-percent across-the-board increase in funding.
CUR+40	The current fire program at plus-40-percent funding represents existing percentage combination of suppression, detection, and prevention in the fire program with a 40-percent across-the-board increase in funding.
SUPCUR	The suppression fire program at current funding increases emphasis placed on the suppression element of the fire program by increasing its percentage share of the total fire budget. The total fire budget is then held at its current level.
SUP-40	The suppression fire program at minus-40-percent funding increases emphasis placed on the suppression element of the fire program by increasing its percentage share of the total fire budget. The total fire budget is then decreased 40 percent below current level.
SUP-20	The suppression fire program at minus-20-percent funding increases emphasis placed on the suppression element of the fire program by increasing its percentage share of the total fire budget. The total fire budget is then decreased 20 percent below current level.
SUP+20	The suppression fire program at plus-20-percent funding increases emphasis placed on the suppression element of the fire program by increasing its percentage share of the total fire budget. The total fire budget is then increased 20 percent above current level.
SUP+40	The suppression fire program at plus-40-percent funding increases emphasis placed on the suppression element of the fire program by increasing its percentage share of the total fire budget. The total fire budget is then increased 40 percent above current level.
PRVCUR	The prevention fire program at current funding increases emphasis placed on the prevention element of the fire program by increasing its percentage share of the total fire budget. The total fire budget is then held at its current level.

Table 2 (continued)
Summary Description of FORPLAN Prescriptions

- PRV-40** The prevention fire program at minus-40-percent funding increases emphasis placed on the prevention element of the fire program by increasing its percentage share of the total fire budget. The total fire budget is then decreased 40 percent below current level.
- PRV-20** The prevention fire program at minus-20-percent funding increases emphasis placed on the prevention element of the fire program by increasing its percentage share of the total fire budget. The total fire budget is then decreased 20 percent below current level.
- PRV+20** The prevention fire program at plus-20-percent funding increases emphasis placed on the prevention element of the fire program by increasing its percentage share of the total fire budget. The total fire budget is then increased 20 percent above current level.
- PRV+40** The prevention fire program at plus-40-percent funding increases emphasis placed on the prevention element of the fire program by increasing its percentage share of the total fire budget. The total fire budget is then increased 40 percent above current level.

Table 3
Comparison of FORPLAN Prescriptions and Management Prescriptions

FORPLAN Rx Alpha Abrev. Code	Description	Analysis areas which include the prescriptions as eligible choices	Corresponding Management Rx
MINLVL	Minimum Level - This allocation usually represents no active manage- ment practice.	All analysis areas	This FORPLAN Rx overlaps all Management Rxs
Timber CLW/O SHW/O CCW/th OVRREM SALVAG UNEVEN STANDM	Timber harvest under a variety of silvicultural sys- tems ranging from sanitation harvest to intensive clear- cutting.	All analysis areas with C.A.S. timber except des- ignated wilderness and Mono Lake National Forest Scenic Area.	9. Modified Tbr Management 10. High Level Timber Mgt. 11. Range 12. Concentrated Recreation Area
Range HMPIBB HWPIBB MEPIBB HMPIBS WPIBS EXMTBB EXMTBS EXMTPN EXMIOT	Livestock grazing with water developments, fen- cing, vegetation rejuvenation and type conversion.	Analysis areas with suitable acreage forage production.	FORPLAN Rxs are compatible with all Mgt. Rxs (with some limitations) except Dev. Rec. and RNA Rxs
Wildlife BRRELW BRRELS WATDEV FENCE	Wildlife habitat improvements through vegetation rejuvenation, water developments and fencing.	Only analysis areas with inventoried suitable wild- life habitat.	3. Mountain Sheep Habitat 4. Mule Deer Habitat 9. Modified Timber Mgt. 10. High Level Timber Mgt. 11. Range 13. Conc. Rec. 14. Semi-prim Recreation
Fish Project LSTLOW LSTMOD MSTLOW MSTMOD HSTLOW HSTMOD	Instream projects to improve fish- eries habitat.	Project analysis area based on streams suitable for fish habitat improvements.	FORPLAN Rxs compatible with all Mgmt. Rxs. except #5, RNA.

Table 3 (continued)
Comparison of FORPLAN Prescriptions and Management Prescriptions

FORPLAN Rx Alpha Abrev. Code	Description	Analysis areas which as eligible choices	Corresponding Management Rx
Recreation DEVCON DEVLOW DEVSTD DEVHAB SHTDWN DISSTD DISLOW DISCON DISHAB	Developed and dispersed recreation Rxs. Management options include new construction, rehabilitation of low standard facilities, full service management, and SHTDWN of sites.	Apply only in concentrated recreation areas, ski areas, potential ski, Further Planning Areas, and wilderness areas.	FORPLAN Rxs are compatible with a broad range of management prescriptions with specific limitations.
Fire CURCUR CUR-40 CUR-20 CUR+20 CUR+40 SUPCUR SUP-40 SUP-20 SUP+20 SUP+40 PRVCUR PRV-40 PRV-20 PRV+20 PRV+40	Wildfire acres burned, suppression costs, and net resource value change were developed for each of the 15 fire program options available in FORPLAN. The model selected a single fire program per decade based on PNV.	All analysis areas with a fire history have a probability of burn factor associated with a net change coefficient based on the current program. A special analysis area was used to evaluate the efficiency of the fire program options with changes in acres burned by alternative.	Wildfire program options are compatible with a broad range of prescriptions with some specific limitations.
Watershed Projects WEIMDF WEIMDH WEIMDW	Activities to rehabilitate degraded wet meadows and watersheds.	Project analysis area based on all wet meadows and watershed acres needing special management.	FORPLAN Rxs are compatible with Management Area Prescriptions except #5., RNA

Time Periods

To assure that the scheduled timber harvest can be achieved and maintained, a 16-decade planning horizon is used in FORPLAN. The first decade of the planning horizon is the period 1986-1995, and is the primary period for which the Forest Plan applies. A total of 16 time periods, each with a duration of 10 years, is used in the modeling process. However, in order to reduce the complexity of data displayed in the EIS, 5 decades are used in all EIS display tables.

Outputs

Outputs are classified as either scheduled or non-scheduled outputs. Both types depend on the prescriptions chosen for each analysis area, but only scheduled outputs depend on the timing of the prescriptions. It is not possible to schedule all outputs through FORPLAN because of modeling limitations, but it is essential to include those that are closely related to the activities being performed on the Forest and that have significant impacts on PNV. Listed in Figure B-4 are the outputs tracked in the planning process.

Outputs are estimated with the use of yield coefficients. For outputs modeled in FORPLAN, these coefficients are built into the yield tables and are used to estimate outputs for all prescription/analysis area combinations. For outputs accounted for outside FORPLAN, yield coefficients are applied to factors that are accounted for both inside and outside of the FORPLAN model. The processes used by the interdisciplinary team to develop the coefficients are summarized in Table 5. For a detailed discussion of yield coefficients, see the FORPLAN coefficient documentation in the planning records or in individual resource FORPLAN records.

Table 4
Outputs Used in the Analysis

Output	Unit of Measure	Scheduled	Non-Scheduled	Inside FORPLAN	Outside FORPLAN
Timber	MCF	X		X	
Timber suitable lands	Acres		X	X	
Optimal LTSY	MCF		X	X	
Optimal ending inventory	MCF		X	X	
Minimum ending inventory	MCF		X	X	
Fuelwood	Cords	X		X	
Range	AUM	X		X	
Water yield	Ac Ft	X		X	
Watershed improvements	Acres	X		X	
Water quality	AcFt	X			X
Developed rec.	RVD	X		X	
ROS class	Acres	X			X
Dispersed rec.	RVD	X		X	
Land acq.	Acres	X			X
Cultural res.	Acres	X			X
Program cost	Dollars	X		X	
Wildlife and fish use	WFUD	X		X	
Wildlife habitat	Acres	X		X	
Fish habitat	Acres	X		X	
Animal number	Number	X			X
T & E species	Acres	X			X
-Bald eagle	Pairs	X			X
-Peregrine falcon	Pairs	X			X
-Lahonton Cutth.Tr.	Acres	X			X
-Pauite Cutth.Tr.	Acres	X			X
Fish	Pounds	X			X
Goshawk	Pairs	X		X	
Wildfire loss	Acres	X		X	
Road constr.	Miles	X			X
Road reconstr.	Miles	X			X
Trail constr.	Miles	X			X
Trail recon.	Miles	X			X
Facilities	Number	X			X
Minerals					
-locatable	Plans	X			X
-leasable	Plants	X			X
Visual quality	Index #	X			X
Human resource	Enrollee	X			X

Table 5
Summary of Yield Coefficients

Inside FORPLAN

Timber (MCF)	Timber yield coefficients were based on Forest inventory completed in 1975 and updated in 1982. A computer program called RAMPREP was used to predict yield coefficients over time for each timber stratum based on volume, age, and growth rate.
Optimal Long-Term Sustained Yield (MCF)	The long-term sustained yield is the maximum timber harvest level that can be maintained indefinitely. This is calculated as a nonscheduled output, based on the highest sustained yield shown for each regional timber type in the regeneration yield tables produced from the RAMPREP model.
Timber-Suitable Lands (Acres)	Timber-suitable lands are those C.A.S. lands to timber management base for each alternative analyzed. This is a nonscheduled output of timber lands assigned to timber Management Prescriptions.
Optimum/minimum Ending Inventory (MCF)	The optimum/minimum ending inventory sets the range, based on CMAI, which the standing timber inventory be within or above in order to assure LTSY. These non-scheduled outputs are based on sustained yield and regeneration yield tables produced from the RAMPREP model.
Fuelwood (cord)	Yield of cordwood was developed based on historic outputs, timber strata, age, and thinning volumes from RAMPREP data.
Range (AUM)	These coefficients yield the AUMs per acre for all range land. They were developed by range conservationists based on posted and existing grazing yield for specific types of brush vegetation. Yields from type conversions of non-commercial and unsuitable timber lands were developed using expected range forage production, selected publications and capital investments for range production.
Water Yield	Water yield coefficients were based on historic precipitation and stream flow data. Vegetation removal for timber management or ski area development was the only potential means for increasing water yield through management practices. Factors such as soil permeability, precipitation, vegetation, and wilderness designation limited Forest-wide suitability for increased water yield to the timbered lands east of San Joaquin Ridge.

Table 5 (continued)
Summary of Yield Coefficients

Output	Process used for developing yield coefficients
Watershed Improvements	<p>The effects of watershed improvements are based on known historic sediment rates on specific streams of WIN-inventoried areas (Kern Plateau, Coyote Mtn., Buttermilk, Horse Mdw., Pizona, White Mtn. and Glass Mtns). The model was forced to rehabilitate some deteriorated watershed lands and to reduce the restoration backlog by applying a technical threshold constraint limiting sediment production to less than 2.911 tons per decade. Coefficients representing the amount of sediment reduction associated with each acre of restoration by intensity of watershed activity were developed. Once the threshold sediment rate was attained, the model had the option of continuing watershed improvement activities or selecting among other activities based on PNV.</p> <p>The sediment coefficients were derived from historic data of WIN-inventoried damaged acres and were applied only to those acres, not Forest-wide. No constraints or associated yield tables were linked to any FORPLAN prescriptions outside the single analysis area containing the WIN-inventoried acres. All the coefficients were developed by the Forest hydrologist in conjunction with the Forest soil scientist and wildlife biologist, based on monitoring activities needed to reduce streambank erosion and sedimentation in streams and wet meadows, scientific literature, and data from adjacent Forests.</p>
Recreation Dispersed (RVD)	<p>All dispersed recreation use, (including wilderness use was based on RVDs for various activities from recreation information management (RIM) data.</p> <p>Dispersed recreation (including wilderness) coefficients were based on current use and the existing inventory of roads, trails, and trailheads. Recreation specialists also inventoried potential for new trails and trailheads, and assumed similar rates of use to determine dispersed recreational capacity coefficients. Dispersed recreation use is valued only to demand capacity in FORPLAN.</p>

Table 5 (continued)
Summary of Yield Coefficients

Output	Process used for developing yield coefficients
Recreation Developed (RVD)	<p>All developed recreation use is based on RVDs for various activities from recreation information management (RIM) data.</p> <p>Developed recreation coefficients were based on inventoried existing developed sites and their PAOT (persons-at-one-time) capacities. The coefficients were derived from practical capacity on a per-acre basis. An inventory of potential developed recreation sites was used to determine potential capacity on the Forest.</p>
Wildlife User Days (WFUD)	<p>WFUDs are a subset of dispersed RVDs. An initial amount of WFUDs are based on RIM estimates. A background coefficient of WFUDs was applied to account for the level of use that would be expected to occur where no special management is implemented. In addition, coefficients were developed to reflect increased WFUD use based on prescriptions that enhance habitat capability for species that create WFUD use. For wildlife, the assumption was that deer are the major factor affecting wildlife-related use. Habitat capability provided on an acre of deer winter or summer range land (which may be improved or reduced as a result of management activity) was translated into user-day coefficients by a formula utilizing hunter success, days hunted, and percent of population harvested. These coefficients were developed by the Forest wildlife biologist, in conjunction with the California Department of Fish and Game.</p>
Fish User Days (WFUD)	<p>Cold water fish (trout) coefficients were developed using a similar process to that of wildlife WFUD development to reflect the number of fish user days. Fish WFUD coefficients were related to fishing success, fish populations, and streams with additional habitat capability. Again, background levels of use occur regardless of management and fisheries improvements. Increases in fish user days occur as a result of applying habitat improvement projects modeled in FORPLAN to enhance and increase fish habitat, thus improving fishing success. These coefficients were developed by the Forest wildlife biologist, in conjunction with the California Department of Fish and Game.</p>

Table 5 (continued)
Summary of Yield Coefficients

Output	Process used for developing yield coefficients
Induced Wildlife/ Fish User Days (WFUD)	WFUDs attributed to other than direct wildlife and fish Management Prescriptions are considered induced WFUDs and were also tracked in FORPLAN. Induced wildlife coefficients were associated with specific range prescriptions when applied to deer winter or summer range. The coefficients were based upon wildlife habitat types, background levels of wildlife use, types of proposed range developments, and intensity of range utilization. Fish-induced coefficients were associated only with specific watershed Management Prescriptions applied to specific riparian areas. These coefficients were based upon stream habitat capability, acres of stream improvement, types of watershed improvements, and increased fish habitat. These coefficients were developed by the Forest wildlife biologist, in conjunction with the California Department of Fish and Game.
Goshawks (pairs)	Core nest areas for goshawks were modeled in FORPLAN. The coefficients were based on Regionally defined acreage requirements necessary for a viable population and were applied to the capable, available, and suitable timber lands. About 450 suitable timber acres were removed from the regulated cut for goshawk nest site protection to meet the minimum management requirement of nine nesting pairs. Unregulated timber yields from those acres would be permissible when appropriate for habitat requirements of this species.
Wildfire Loss net (Acres)	Burned acres, with associated suppression costs and resource value change due to wildfire were modeled in FORPLAN. The amount of wildfire expected to occur was developed for three different fire program options (i.e. program strategies, such as prevention emphasis or suppression emphasis) using the FIREPLAN Initial Attack Model. These were integrated into FORPLAN and the expected wildfire acres occurring is related to the fire program option and budget level selected by FORPLAN.
Effective Alteration (Acres)	Coefficients for effective alteration (EFFALT) track the acres of vegetation visually modified by regeneration cutting. The coefficients were developed based upon type of vegetative strata, growth rates and visual characteristics.

Table 5 (continued)
Summary of Yield Coefficients

Output	Process used for developing yield coefficients
Program Costs (dollars)	<p>This is the sum of fixed costs for minimum level management, the cost for the fire program, and all costs not directly associated with a single resource, as watershed and fisheries projects. All costs were developed by resource staff officers and the Forest economist, using past records.</p> <p style="text-align: center;"><u>Outside FORPLAN</u></p>
Animal numbers	<p>Wildlife animal numbers were predicted based on their habitat requirements. Using WHR (wildlife habitat relationships) types and expected habitat changes over time, animal numbers were estimated for each alternative.</p>
T&E Species	<p>The Forest currently provides suitable habitat for the endangered bald eagle and peregrine falcon, as well as the threatened Lahontan and Paiute cutthroat trouts. These species can be maintained at levels to meet recovery objectives by following established Forest direction and proposed standards and guidelines. These species were not included in the model, as they are assumed to maintain current populations or to reach recovery objectives in all benchmarks and alternatives.</p>
Pounds of Fish	<p>Pounds of fish were calculated as a function of miles of stream, existing stream condition, and acres of stream improvement.</p>
ROS (acres)	<p>Acres by recreation opportunity spectrum (ROS) class were based on the existing physical setting, scheduled recreation development, timber harvesting, and road and trail construction and/or obliteration. Administrative setting (e.g, ORV restrictions) was also considered.</p>
Road Construction	<p>The construction of roads for new developed recreation facilities and for timber harvest access were estimated outside FORPLAN based on a transportation plan developed from aerial photos, developed recreation inventories, net acres of timber harvested, and local knowledge. The costs of road construction were embedded into the timber and developed recreation cost; however, the actual road mileage constructed was not an output from FORPLAN.</p>

Table 5 (continued)
Summary of Yield Coefficients

Output	Process used for developing yield coefficients
Road Reconstruction	Road reconstruction is based on existing road inventory and maintenance plans. Costs for these activities were developed from historical timber and developed and dispersed recreation data and embedded in the costs for these resources in FORPLAN. The actual mileage of road reconstruction was not tracked in the model.
Trail Construction (miles)	Trail miles and trailheads were calculated outside FORPLAN based on the current trail system, areas allocated to wilderness, and the potential trails and trailheads available for dispersed recreation activities. Costs for these facilities and potential facilities were developed from historical data and embedded in the dispersed recreation and wilderness costs in FORPLAN.
Trail Reconstruction (miles)	Trail reconstruction is based on the existing trail inventory and reconstruction program. Costs are embedded in FORPLAN as part of wilderness and dispersed recreation costs; miles were generated outside the model.
OHV areas (miles and acres)	There were no coefficients for this output. Based on the total number of dispersed RVDs, miles of road and trail, and the alternative theme, the recreation staff developed the outputs for miles of open, closed, and seasonal ORV roads and trails and ORV open areas.
Minerals	<p>The predicted number of operating plans was based on mineral potential of acres available for mineral entry in relation to the current availability and number of plans.</p> <p>It was assumed that geothermal energy development would occur in Lease Blocks I and II in all alternatives and benchmarks. Based on stipulations made in the environmental assessments for these lease blocks, it was estimated that 6 power plants would be producing 250 megawatts of electrical power annually by the end of the planning horizon. This benefit was embedded in FORPLAN.</p>

Table 5 (continued)
Summary of Yield Coefficients

Output	Process used for developing yield coefficients
Facilities	There were no coefficients for this output (i.e. dams, reservoirs, or administrative sites). It was assumed that the only change from the base year in numbers of facilities would be the addition of a visitor center for the Mono Basin National Forest Scenic Area. This is common to all alternatives.
Future Visual Quality (acres)	The Management Prescriptions associated with each alternative were mapped and the acres by visual condition resulting from these activities estimated. The FVC reflected in these VQOs were calculated as a function of visual quality changes.
Visual Quality Index	The visual quality index is calculated by multiplying numerically weighted variety class acres by the visual condition. The result is an indicator of visual quality. VQI will change by alternative as proposed management activities change the visual condition.
Land Acquisition (acres)	The estimate of additional lands needed to efficiently manage the Forest was based on the theme of each alternative.
Human Resources (enrollees)	There were no coefficients for this output. Numbers were estimated using historical data and are expected to remain the same for all alternatives.
Cultural Resources (acres)	Various levels of program intensities to reflect the theme of each alternative were defined and the costs were estimated.
Water Quality (acre-feet)	There were no coefficients developed Forestwide for water meeting water quality standards. The volume of water meeting State water quality objectives was estimated from the soil and water program, acres of soil disturbance, new ski area and road construction, acres in declining condition, and total budget. Based on the assumption of proper application of BMP's, Forest standards and guidelines, and current ski area erosion prevention plans, virtually all water yield would meet State water quality standards.

Economics in FORPLAN

Economics are discussed in Chapter II of the EIS in the alternative development process and displayed in various figures in Chapter III of the EIS in the economic environment. Chapter IV discusses the economic

consequences, and Appendix D outlines the use of economics in the entire document. Demand analysis for individual resources is presented in the Affected Environment, Chapter III. Demand cut-offs are used for all dispersed and developed RVDs, skier RVDs and wilderness RVDs, and for wildlife WFUDs.

All costs and benefits of the economic efficiency analysis were conducted with the use of the FORPLAN model. Economic data and assumptions incorporated into FORPLAN are described below:

Discount Rate: An interest rate of 4.0 percent was used to determine the present value of future benefits and costs. This rate approximates the long-term cost of capital in the private sector, as measured by the return on AAA corporate bonds after adjustment for inflation. ^{1/} For sensitivity testing, a discount rate of 7-1/8 percent was used. This rate was used for water resource evaluation by the U.S. Water Resources Council in 1980 and also adopted for use in the 1980 RPA. Use of the 7-1/8 percent discount rate reduces PNV from that obtained with a 4 percent rate. Data on PNV for each alternative using the 7-1/8 percent discount rate is available in the planning records.

Base Year for Dollar Values: All dollar values are expressed in 1982 dollars. The following factors based on the implicit price deflator for gross national product were used to adjust values from other years to 1982.

<u>Year</u>	<u>Factor</u>
1978-82	1.39
1979-82	1.28
1980-82	1.18
1981-82	1.08

Real Cost and Price Trends: The real cost and price trends used for timber are shown below:

	<u>Decade</u>				
	1	2	3	4	5
Timber price increase, average annual percent	4.78	1.09	2.06	1.57	1.84
Timber cost increase, average annual percent	3.10	2.40	1.90	1.60	1.60

^{1/} See Row, Clark; H. Fred Kaiser, and John Sessions, "Discount Rate for Long-term Forest Service Investments" Journal of Forestry, June 1981 for a complete discussion of the rationale for the discount rate.

These timber price trends are projections from an econometric model of National and Regional timber markets. 1/ The timber cost trends are based on projections of per capita disposable personal income because timber management cost increases have historically been highly correlated with increases in per capita disposable income. 2/

Costs and prices for all other resources were held constant since FORPLAN version 1, Model 2, release 13, cannot utilize cost and price trends for both timber and nontimber resources.

Benefits: The dollar values for outputs used to calculate PNV are the prices that consumers would be willing to pay for Forest outputs, whether or not such prices are actually collected by the federal government. At present it is national policy to provide most Forest outputs at either no charge to consumers or at a charge less than the willingness-to-pay price. This is shown in the following tabulations in Table 6.

Table 6
Benefits Used in the Analysis

Output	Unit	Valued in FORPLAN	Valued Outside FORPLAN	Average Actual Cash Receipts per Unit of Output	Average Willingness-to- Pay Value Used in this Analysis
<u>Timber</u>					
Initial Harvest					
0-30% Slope (tractor)					
-Jeffrey Pine	MCF	X		877	877
-Red Fir	MCF	X		482	482
-Lodgepole Pine	MCF	X		154	154
31-60% Slope (aerial)					
-Jeffrey Pine	MCF	X		-162	-162
-Red Fir	MCF	X		-457	-457
-Lodgepole Pine	MCF	X		-1308	-1308

- 1/ Haynes, Richard W.; Kent P. Connaughton; and Darius M. Adams; "Stumpage Price Projections for Selected Western Species", USDA Forest Service Research Note PNW-367, November 1980.
- 2/ USDA Forest Service, An assessment of the Forest and Range Land Situation in the United States, January 1980.

Table 6
Benefits Used in the Analysis

Output	Unit	Valued in FORPLAN	Valued Outside FORPLAN	Average Actual Cash Receipts per Unit of Output	Average Willingness-to- Pay Value Used in this Analysis
<u>Timber (continued)</u>					
Regenerated Timber-Final Harvest					
0-30% Slope (tractor)					
-Jeffrey Pine					
Diameter class	8	MCF	X	473	473
	12	MCF	X	614	614
	16	MCF	X	728	728
	20	MCF	X	807	807
	24	MCF	X	850	850
	28	MCF	X	877	877
-Red Fir					
Diameter class	8	MCF	X	250	250
	12	MCF	X	347	347
	16	MCF	X	419	419
	20	MCF	X	477	477
	28	MCF	X	472	472
-Lodgepole Pine					
Diameter Class	8	MCF	X	108	108
	12	MCF	X	128	128
	16	MCF	X	142	142
	20	MCF	X	149	149
	24	MCF	X	154	154
31-60% Slope					
-Jeffrey Pine					
Diameter class	8	MCF	X	-465	-465
	12	MCF	X	-325	-325
	16	MCF	X	-211	-211
	20	MCF	X	-132	-132
	24	MCF	X	- 88	- 88
	28	MCF	X	- 62	- 62
-Red Fir					
Diameter class	8	MCF	X	-250	-250
	12	MCF	X	-347	-347
	16	MCF	X	-419	-419
	20	MCF	X	-457	-457
	24	MCF	X	-477	-477
	28	MCF	X	-472	-472

Table 6
Benefits Used in the Analysis

Output	Unit	Valued in FORPLAN	Valued Outside FORPLAN	Average Actual Cash Receipts per Unit of Output	Average Willingness-to- Pay Value Used in this Analysis
<u>Timber (continued)</u>					
-Lodgepole Pine					
Diameter class 8	MCF	X		-1395	-1395
12	MCF	X		-1375	-1375
16	MCF	X		-1361	-1361
20	MCF	X		-1353	-1353
24	MCF	X		-1348	-1348
Fuelwood	Cords	X		5.00	7.89
<u>Range</u>					
Livestock grazing	AUM	X		1.86	10.70
Wild Horse & Burro	Animal	X		200	200
<u>Recreation</u>					
Dispersed, Std.	RVD	X		0	11.30
Dispersed, Low Std.	RVD	X		0	5.99
Developed, Std	RVD	X		0.82	11.20
Developed, Low Std.	RVD	X		0.82	5.94
Developed, Alpine Ski	RVD	X		0.82	11.20
Wilderness Std.	RVD	X		0	13.75
Wilderness, Low Std.	RVD	X		0	7.29
<u>Wildlife and Fish</u>					
Resident Fish Use	WFUD	X		0	12.00
Big Game Use	WFUD	X		0	30.00
Other Game Use	WFUD	X		0	18.00
Nongame Use	WFUD	X		0	25.00
<u>Water</u>					
Water yield	Ac-Ft	X		0	59.00
Sediment	Tons	X		0	-10.00

**Table 6
Benefits Used in the Analysis**

Output	Unit	Valued in FORPLAN	Valued Outside FORPLAN	Average Actual Cash Receipts per Unit of Output	Average Willingness-to- Pay Value Used in this Analysis
<u>Energy</u>					
Geothermal	BBTU	X		253.00	253.00
<u>Fire</u>					
Wildfire	Acres	X		0	-1172.00

Outputs above the estimated demand were not valued. For outputs used off-site, benefits are based on the value of the outputs as they leave the land or production site. For outputs used on-site, benefits are valued when use takes place. However, in cases where it is easier to derive values after the output leaves the production site, costs incurred and profits earned after the output leaves the site were deducted from the values at later production stages.

Recreation and wildlife and fish user day values are the estimated average amount that recreationists are willing to pay at the site. These values are based on a national survey of travel costs and contingent value recreation studies conducted by the Forest Service for the Draft 1985 Resource Planning Act (RPA) evaluation.

Range values are the average amount that permittees are willing to pay for grazing on the Forest as estimated from ranch livestock budgets developed by the USDA Economic Research Service.

Water values are the estimated amount that users are willing to pay for water at the point of use, less storage and delivery costs incurred to get the water from Forest streams and rivers to the user. Values were determined from studies surveyed by the Forest Service for the Draft 1985 RPA. 1/

Sediment values are negative values that represent the cost of sediment removal or cleanout. They are based on costs incurred by the Forest and other public agencies in the area, and studies conducted by the Forest. These values were applied only to the wet meadow areas and streams in the WIN-inventoried area. Otherwise, sediment is given a value of zero Forest-wide.

1/ Draft Environmental Impact Statement 1985-2030 Resources Planning Act

Energy values for geothermal energy represent value of the energy at the wellhead as estimated by the Forest Service for the 1985 Resource Planning Act (RPA) evaluation.^{1/}

Demand Cut-Offs for Benefit Values: Benefit values are applied only where there is a demand for the output by Forest users. Outputs that exceed demand are given a benefit value of zero, while those that are produced at or below the quantity demanded by consumers are assigned the benefit value described in the previous section. This is handled with the use of a demand cut-off. Most of the outputs from the Forest are consumed in national and regional markets where the quantity demanded is many times larger than the productive capacity of the Forest (see Chapter III for a resource-by-resource description of the demand situation). For this reason, demand cut-offs were developed only for recreation visitor days (RVDs) and wildlife and fish user days (WFUDs). For these resource outputs, public demand could be less than the productive capacity of the Forest. The demand cut-offs were generally effective in the early time periods limiting resource outputs; however, cost-effective supply and/or constraints unique to alternatives were more often limiting than were the demand cut-off limits in the case of recreation outputs.

The demand projections listed in Table 7 are based on historic RIM data and projected into the future using factors developed in the 1980 RPA indexes of demand for outdoor recreation by type of activity. These factors were developed by Region; within Region 5, they were based on growth in major population centers. The Southern California area had a major influence upon the factors developed for Region 5, and provides the majority of the Forest's users.^{2/}

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- ^{1/} Draft Environmental Impact Statement 1985-2030 Resources Planning Act
^{2/} USDA Forest Service, An assessment of the Forest and Range Land Situation in the United States, January 1980.

Table 7
Demand Cutoffs Used in FORPLAN

Decade	1	2	3	4	5
Dispersed Recreation (MRVDs) Demand by Decade	14190	18203	22123	26656	31769
Wilderness Demand by (MRVDs) Decade	8626	9967	11861	13833	15647
Developed Recreation (MRVDs) Demand by Decade	26654	32364	37913	43566	48673
Downhill Ski Demand (MRVDs) by Decade	12633	17702	24798	32440	41953
Wildlife WFUD Demand (MWFUDs) by Decade	531	606	694	794	888
Fish WFUD Demand by (MWFUDs) Decade	3420	3685	4215	4711	5159

Costs: All costs used in the analysis are estimates based on accounting records and the experience of project managers. Costs for applying the different multiple resource prescriptions were estimated and built into the economics tables in FORPLAN. The cost associated with timber sale preparation and administration, regeneration, and road construction/reconstruction are included. Costs for constructing roads are included where a new area is being opened for timber harvest. Administration and capital investment costs are included for soils and water, range, wildlife, and recreation programs. Funds for firefighting and fire management are included. Finally, construction, reconstruction, and maintenance costs are included for campgrounds, interpretive facilities, trails, trailheads, administration of special-use permits, water developments, fencing, and streambank stabilizing structures.

Base level operational costs (fixed costs) include general administration, program management, minerals management, special use management, water and soil improvement maintenance and monitoring, road and trail systems maintenance, fire detection and initial attack, and law enforcement. Approximately 22 percent (\$2,139,000) of the current budget represents fixed costs which are not allowed to vary in any benchmark or alternative.

Costs were checked for reasonableness by comparing the first decade costs for the current alternative developed with use of FORPLAN against actual expenditures for FY 1982.

Constraints

Each of the resources discussed in 36 CFR 219.13 through 219.26 were addressed by Standards and Guidelines, Management Prescriptions, or other management direction in the Plan. Regional resource direction which Forests are expected to follow is found in Regional Land Management Planning Direction.

Some management requirements were translated into modeling constraints and simulated or proxied in FORPLAN. Constraints are quantifiable limits placed on the model to ensure that minimum or maximum acres or dollars are used, or that specific minimum or maximum amounts of outputs are produced. Constraints override the objective in linear programming analysis. Thus where a predetermined level of output, minimum physical condition, or allocation is entered as a constraint, it is always achieved (or no feasible solution is found). Output levels and other desired effects entered as constraints presumably contribute more to public benefits than their cost of production plus the foregone public benefits of any outputs or other effects they replace. For this reason, the interdisciplinary team tried to formulate constraints that met objectives with the lowest cost and least effect on other outputs. In most cases, this required the formulation and testing of several alternative sets of constraints to determine the most cost-effective set (in terms of PNV) that would meet the objectives. Constraints used in this analysis are divided into four categories: technological constraints, minimum management requirements, minimum implementation requirements, and Forest constraints. The following is a discussion of the modeling rules and impacts associated with each type of constraint.

Technical Constraints: Technical constraints are needed to make the model work and to ensure technical implementability of the results. These are applied to all benchmarks and alternatives. Limiting the prescription set for an analysis area to only those activities for which the area is available and capable of sustaining is one type of technological constraint. For example, limiting timber harvest prescriptions to areas that are capable and available for timber harvest. Demand cutoffs and considering existing developed recreation sites suitable only for developed recreation are other examples. In addition, threshold limits are set that restrict the production of resource outputs either to meet demand or other identified technical limitations. Constraints numbered 100 through 170 1/ were needed to prevent the model from double counting by allocating the same acres of suitable range to two or more prescriptions.

Constraints 002 through 015 limit the number of RVDs, WFUDs and tons of sediment that can be produced to an amount less than or equal to the constraint in each period. The RVDs and WFUDs produced above the threshold constraints are not valued, while sediment production beyond the constraint limits models the Forest's inability to restore backlogged non-point sources of sediment in the WIN-inventoried areas. (See the previous section for additional information on demand cutoffs.) The sediment threshold cutoff has been developed from historic data for the WIN-inventory damaged acres. They require the model to restore the backlog of non-point sources of sediment. The sediment yield threshold reflects an attempt by the Forest to resolve the non-point sources of sediment.

Decade	1	2	3	4	5
Sediment limit (M tons)	2.911	2.911	2.911	2.911	2.911

Minimum Management Requirements (MMRs): Minimum Management Requirements (MMRs) are constraints needed to meet minimum standards set forth in 36 CFR 219.27. Procedures for defining the MMRs were specified by the Pacific Southwest Region. MMRs are applied to all benchmarks and alternatives but are not applied to the FLW (unconstrained max PNW with flow/litsy--long term sustained yield--constraints) or the MLV (minimum level of management) FORPLAN runs. The MMRs generally represent requirements that are outside of Forest Service authority to change. They are based on statutes and regulations, in contrast to manual direction or agency policy. Some examples of MMRs are: lands not available for timber production, T&E species recovery, viable populations of wildlife and fish, vegetative diversity, riparian area protection, soil and water productivity, and certain timber policy constraints.

A discussion of the modeling rules and associated impacts for each MMR follows. See the modeling specifications in the benchmark section of this appendix for additional specifics.

1. Tentatively Capable, Available, and Suitable Timberland: Lands that were tentatively suitable for timber management were placed in analysis areas and were given a range of appropriate prescriptions. Land not suitable for timber management were placed in other analysis areas where timber prescriptions were not an option. A detailed discussion of the timber suitability criteria is contained in the timber AMS in the planning records. The effect of limiting the land base to only those acres that are now available, have a reasonable chance of successful reforestation, and for which knowledge indicates no irreversible damage to soil productivity or watershed condition defines the acres that are available for scheduled harvesting, reforestation, and thinning. This establishes the maximum land base available to sustained yields of timber.
2. Threatened and Endangered Species: The bald eagle is a federally-listed endangered species. The Forest has a wintering population of bald eagles, but no nesting pairs. No coefficients were developed for this species. Currently the Forest has no recovery target.

The peregrine falcon is also an endangered species. The Forest portion of the Peregrine Falcon Recovery Plan calls for the introduction of two pair within the planning period. No specific coefficients were developed for the peregrine falcon in the analysis.

The Lahontan cutthroat trout and the Paiute cutthroat trout are federally-listed threatened species. The current management direction is to protect and enhance habitat to meet population recovery objectives.

1/ These constraint numbers refer to the actual constraint in the FORPLAN matrix, and are offered as an aid to readers who are interested in reviewing the actual mathematical structure of the constraints. The linear program matrixes and reports are included in the planning records.

Coefficients were developed based upon habitat capability, stream acres, and management activities. The recovery objectives are five acres of increased stream habitat for the Lahontan cutthroat and eighteen acres for the Paiute cutthroat trout. In the case of both trout, there is more suitable stream habitat available than is needed to meet recovery objectives. The Paiute Cutthroat Trout Habitat Management Plan is presently available, and the Lahontan Cutthroat Trout Habitat Management Plan will be available in the near future.

Standards and guidelines designed to protect the bald eagle, peregrine falcon, Lahontan trout, Paiute trout, and their habitats do not conflict with other resources, and were therefore not modeled in FORPLAN.

3. Viabile Populations: A viable population is regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence. Constraints were entered in FORPLAN for for viable populations in two areas: goshawks, and snag-dependent species.

Goshawks: Within its habitat range, manage goshawk territories to maintain a density of at least one territory per eighteen square miles. Distances between territories or clumps of territories should not exceed 12 miles. The habitat range is defined as the area of land containing active or potential nesting habitat and was considered to encompass the entire suitable timber base on the Forest.

To meet the minimum management requirements for goshawks, the wildlife biologist determined that nine pairs are necessary within the tentatively suitable timber base. Each territory will contain a minimum of 50 acres of habitat which provides suitable conditions for the nest stand and an alternate nest stand. To maintain these nine pairs, 450 acres of productive mature timber were forced in the model to salvage and stand maintenance timber management, which removed these acres from regulated harvest. Special consideration, identified in the Forest-wide Standards and Guidelines, is applied to these areas.

Unique conditions exist on the Forest for the goshawk. Because of the high recreation use, open timber stands, ease of access, and habitats bordering on the southernmost extent of their range, local studies indicate goshawks may need upwards of 100 acres of protective area surrounding the nest sites. Alternatives PRF, AMB, and AMN provide this additional protective area.

Snag-dependent Species: To provide habitat for snag-dependent species, it was determined that an average of 1.5 snags per acre were required with the following specifications:

- 1.2 snags per acre between 15-24 inches dbh and greater than 20 feet high;
- 0.3 snags per acre greater than 24 inches dbh and greater than 20 feet high.

To provide this level of snags, every other decade's thinning volume for high-site timber land was given up, slightly reducing the maximum long-term sustained yield.

4. Diversity: A diversity of plant and animal communities was achieved by providing threshold levels of vegetation types and seral stages. These vegetative type/seral stage combinations are described below.

Timber types:

Jeffrey pine
Red fir

Seral stages:

- 1 = Grass/forb stage, with or without scattered shrubs and seedlings.
- 2 = Shrub/seedling/sapling stage.
- 3a = Pole/medium tree stage with canopy cover less than 39 percent.
- 3bc = Pole/medium tree stage with canopy cover over 40 percent.
- 4a = Large tree stage (mature and overmature) with canopy cover less than 39 percent.
- 4bc = Large tree stage with canopy cover over 40 percent.
- 4c+ = Overmature large tree stage with tree canopy of over 70 percent.

Shrub Types: Big Sage, Bitterbrush, and Mountain Mohogany.

Seral Stages: Early Stage, Middle Stage, and Late Stage.

FORPLAN solutions were monitored to insure that at least 5 percent of each vegetative type/seral stage combination was present for each decade. This was never a problem in any of the benchmarks or alternatives, and no diversity constraints were ever explicitly imposed.

5. Riparian Areas: The aquatic, riparian, and terrestrial habitat associated with riparian areas is important to a large variety of wildlife species. Riparian areas are defined as vegetative communities which are predominantly influenced by, or associated with, water; they include:

- Areas 100 feet horizontal distance from the edge of standing bodies of water;
- Areas 100 feet horizontal distance on both sides of perennial stream channels;
- all wetlands.

Riparian areas were identified on the Forest by calculating the acres associated with perennial streams or lakeshores, and acres of wet meadow in the Forest data base. Protection of riparian areas was modeled in FORPLAN by allowing only salvage and sanitation timber management activities within riparian areas, reducing the timber yield on 360 acres. An additional 23,500 acres of wet meadow were constrained to accept only watershed improvement prescriptions. (Livestock grazing was

limited to levels allowed in watershed improvement prescriptions in these areas.) All new developed recreational facilities were to be located outside riparian areas.

Intermittent and ephemeral streams were acknowledged to be important to riparian areas, but were not constrained as part of the MMRs. In addition, the Forest Standards and Guidelines applied to all alternatives further described riparian areas, and the appropriate activities and management within them.

6. Soil and Water Productivity: This constraint limited the disturbance on those areas with steep slopes, very high erosion potential, or high instability, to no more than 5 percent per decade. Disturbance is defined as any management activity that has the potential to accelerate erosion or mass movement. Steep slopes are slopes in excess of the natural angle of repose. Very high erosion potential is defined in the R-5 supplement no. 18, FSM 2550, May 1976.

No constraint was applied specifically for soil and water productivity protection, as the intent of this objective was already met by removing the non-regenerable acres from the capable, available and suitable (CAS) timber land base. The removal of these lands from timber activity, the limitation of range activities to 30 percent slopes or less, and the implementation of the Forest-wide Standards and Guidelines and Management Prescription direction provide the intended protection for soil and water productivity.

Timber policy constraints (TPCs): These constraints ensure that timber harvest meets the requirements of sustained yield and harvest flow, no harvest before the Culmination of Mean Annual Increment (CMAI), and dispersion requirements.

1. Rotation Length: Minimum ages were established for merchantability, Culmination of Mean Annual Increment (CMAI), and 95 percent of CMAI based on RAMPREP yield tables for the major forest types. Rotation length was extended based upon RAMPREP yield tables in response to public issue with the appearance of the forest in the future. See Table 8 for display.

Table 8
Rotation Lengths
(years)

	Merchantable	CMAI	PRF	95 percent CMAI
Jeffrey Pine				
w/o thinning	80	70	120	70
w/thinning	80	80	140	80
Red fir				
w/o thinning	80	50	80	50
w/ thinning	80	180	180	140
Lodgepole pine				
w/o thinning	80	80	100	70
w/thinning	80	100	120	80

2. Sustained Yield Requirements: An inventory constraint and a growth goal were used to meet the sustained yield requirements.
3. Harvest Flow Requirements: The amount that timber outputs were allowed to fluctuate between periods was regulated to prevent wide fluctuations from one decade to the next. Twenty-two percent was the usual constraint, but a 99 percent increase was allowed in the RPA Alternative.
4. Dispersion: FORPLAN was constrained to allow no more than 16 percent of any watershed association to be regenerated in any period. This constraint assures that harvest units can be situated in such a way as to leave logical harvest units between openings for future management.

Minimum Implementation Requirements (MIRs): These constraints are needed to ensure that alternatives are minimally acceptable and implementable on the ground. Procedures for defining MIRs were specified by the Region. They are within agency control, but there is little discretionary control regarding their application at the Forest level. MIRs do not apply to benchmarks but are applied to all alternatives. Only two MIRs were applicable to the Forest. Sensitive plants must be managed to insure that they do not become threatened or endangered because of Forest Service action. This requirement is satisfied on the Forest by Standards and Guidelines. Partial Retention Visual Quality must be maintained in the foreground and middle ground of scenic corridors for roads officially designated in the 1970 California State and County Scenic Highway System Master Plan. (State Highways 158, 168, 203 and U.S. 395 and the western portion of U.S. 120 are in this category.) Timber harvest was restricted to salvage and sanitation FORPLAN prescriptions on 4,207 acres of suitable timber stands along these corridors.

Forest constraints common to all alternatives: This category of constraints is needed to ensure implementability at the local level. They are based on Forest (rather than Regional) conditions which are in addition to MMRs. Fixed allocations representing prior Forest commitments include the established and candidate RNAs, the Mono Basin National Forest Scenic Area, the Ancient Bristlecone Pine Forest Botanical Area, geothermal leasing in Lease Blocks I and II, all designated wilderness, and the North and South Fork of the Kern Wild and Scenic Rivers and the Middle Fork of the San Joaquin recommended wild and scenic rivers. Other than these land allocations, no Forest constraint was common to all alternatives. Forest constraints unique to an alternative are discussed under alternative descriptions.

Summary of the Constraint Analysis: For a detailed discussion of constraint analysis by subtraction, refer to Chapter II of the EIS. The following Table displays the marginal costs of the Minimum Management Requirements and the Minimum Implementation Requirements.

The alternatives were developed from the most economically efficient, unconstrained benchmark (FLW), with additional constraints added only as necessary to meet the theme of the alternative. The first set of constraints added were the MMRs, which are necessary to meet the NFMA regulations. For the Inyo, these included protection of goshawk nest sites (450 acres), and protection of riparian areas (360 acres). The MMRs restrict timber practices and cause a \$0.3 million reduction in PNV. The MMR benchmark is further

constrained by the MIRs to create the most efficient, implementable alternative (CEE). The visual quality MIRs affected another 4,207 acres of timber that went to salvage and sanitation cutting in FORPLAN.

Table 9
Present Net Value Comparison-Marginal Cost of Constraints
in Millions of 1982 Dollars

I.D. Code Name	PNV	Change In PNV	Dis-counted Cost	Change In Disc. Cost	Dis-counted Benefits	Change In Disc. Benefits
FLW* (PNV w/o MMRs)	1879.4	N/A	288.7	N/A	2168.1	N/A
MMR* (PNV w/MMRs)	1897.1	0.3	288.9	0.2	2168.0	0.1
CEE*(PNV W/MMRs)	1897.0	0.1	287.6	1.3	2166.6	1.4

MLV (Min-lvl. Management)	1605.1	N/A	81.1	N/A	1686.2	N/A

*Background output (MLV) benefits, costs, and PNV have been subtracted from those for each of the other benchmarks and alternatives.

BENCHMARKS

This section presents the modeling specifications for the required benchmarks. For a complete discussion of the results of the benchmarks, refer to Chapter II of the EIS.

04MLV - Minimum Level of Management (Background)

Because this benchmark is primarily used as an accounting tool, the phase-in period that would be needed if minimum level were actually implemented is ignored.

Theme: The purpose of this benchmark is to determine unavoidable fixed costs, outputs, and associated benefits with maintaining the Forest in federal ownership.

Modeling Specifications:

1. Objective function: Minimize cost for twelve periods.

2. State and county roads and background hunting and fishing are allowed to produce a minimum level of dispersed recreation RVDs and WFUDs.
3. Other outputs (timber, range, developed recreation, etc.) were not produced, as a result of the minimize-cost objective function. Other constraints were not needed.
4. The minimum level fire program included detection and initial attack only.

04FLW - Unconstrained Maximum PNV Assigned with FLOW/LTSY Constraints

Theme: This benchmark displays the most economically efficient allocation of resources. Management activities are constrained only by the production limitations of the land and by the requirements of technical feasibility. FLW provides a basis for evaluating the cost of the MMRs.

Modeling Specifications:

1. Objective function: Maximize PNV for 12 periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation length at merchantability.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements do not apply.
 - Non-declining yield requirements do not apply.

04MMR - Maximum PNV Assigned Values with MMR-NDY-CMAI

Theme: The purpose of the MMR benchmark is to display the outputs that could be produced if management were constrained only to meet Minimum Management Requirements. This benchmark demonstrates the opportunity costs of those requirements, considered collectively. It forms the basis for evaluation of additional constraints. The MMRs are derived from 36 CFR 219.27.

Modeling Specifications:

1. Objective function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002, through 015).
3. Timber Policy Constraints
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.

- Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
 5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were allocated to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.

04MKV - Maximum PNW Market Values Only with MMR

Theme: This benchmark demonstrates the sensitivity of the FORPLAN solution to non-market resources (water, fish, wildlife and dispersed recreation) price assignments. Non-market outputs are not valued and contribute to PNW only after the solution is found; therefore, they do not affect the allocation of resources.

Modeling Specifications:

1. Objective function: Maximize PNW for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were allocated to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.
6. Water, WFUDs, and dispersed RVDs were given no value in the FORPLAN run. The solution was then run through the report writer to price out all assigned values, including the nonmarket outputs (water, WFUDs dispersed RVDs).

04TBR - Maximize Timber for 1 Period with NDY - CMAI - MMRS

Theme: The theme of this benchmark is to define the maximum timber output possible for the first decade, applying the constraints of NDY, CMAI and MMRS.

Modeling Specifications:

1. Objective function: Maximize timber for one period.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.

04WLN - Maximize PNV with Maximum Wilderness

Theme: The theme of this benchmark is to display the opportunity cost associated with a maximum wilderness allocation.

Modeling specifications:

1. Objective function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.

4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.
6. Wilderness allocations for all Further Planning Areas was assured by turning on appropriate wilderness choices for aggregates 291 through 993.

04NON - Maximum PNV with No Roadless Areas to Wilderness

Theme: The theme of this benchmark is to display the opportunity cost associated with making no new wilderness allocations.

Modeling Specifications:

1. Objective function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.
6. Nonwilderness allocations for Further Planning Areas was assured by constraining appropriate wilderness choices for aggregates 291 through 993.

04RGN - Maximum Range - Grazing for Five Periods (50 Years)

Theme: The theme of this benchmark is to display the maximum capability of the Forest to provide commercial livestock grazing for five decades.

Modeling Specifications:

1. Objective function: Maximize grazing for five periods.

The resulting AUM production is specified as a scheduled output constraint in a subsequent (rollover) maximum PNV run.

2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.

04H20 - Maximum Water for Five Periods (50 Years)

Theme: The theme of this benchmark is to define the maximum capability of the Forest to provide water for five decades.

Modeling Specifications:

1. Objective function: Maximize water yield for five periods.

The resulting water yield is then specified as a scheduled output constraint for a subsequent Max PNV (rollover) run.

2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.

- Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
 5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.

ALTERNATIVES ELIMINATED FROM DETAILED STUDY

For a more complete discussion of the alternatives eliminated from detailed study and the reasons for their elimination, see Chapter II of the EIS.

04PRO - High Productivity

Theme: This alternative was designed to illustrate the effects of meeting the Regionally-assigned high productivity timber target alternative as disaggregated to the Forest for the years 2000 and 2030. Other market outputs are provided at the highest level possible while meeting the assigned timber targets. Non-market outputs are provided at economically efficient levels consistent with the production of market outputs.

Modeling Specifications:

1. Objective function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply, only in the 6th decade is the yield allowed to decline.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres

(50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.

6. Constraint 017 sets a minimum timber output to be produced, ranging from 33.8 MMCF in the 1st period to 43.1 MMCF in the 5th period.
7. Constraint 016 sets a minimum range output to be produced, ranging from 41.5 MAUMs in the first decade to 55.7 MAUMs in the fifth decade to meet the President's national range target.
8. The MIR constraint was not applied, in order that the timber harvest targets could be met.

04MKT - Market Opportunities Emphasis

Theme: This alternative emphasizes high output levels of market resources (timber, range, and developed recreation) with non-market outputs at economically efficient levels.

Modeling Specifications:

1. Objective function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVD, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply, only in the 6th decade is the yield allowed to decline.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.
6. Constraint 017 sets a minimum timber output to be produced, ranging from 30.1 MMCF in the 1st period to 38.5 MMCF in the 5th period.

7. Constraint 016 sets a minimum grazing output to be produced, ranging from 45.1 MAUMs in the first decade to 55.7 MAUMs in the fifth decade to meet the President's national range targets.
8. The MIR constraint was not applied in order that the timber harvest targets could be met.

04LBU - Low Budget Alternative (25 percent Reduction to Budget)

Theme: This alternative is designed to estimate the expected outputs and services that could be provided in the future if the current budget was equal to 75 percent of the 1982 funding (or \$7.3 million per year).

Modeling Specifications:

1. Objective function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.
6. MIRs for visual resources assigned 4,207 acres of suitable timber along State-identified scenic highways to salvage and sanitation. Constraints 031 through 049 set the visual restriction.
7. A financial constraint adjusted the budget to equal 25 percent of the 1982 funding level (\$73 MM per decade).
8. Aggregates 582 and 642 were turned on and constraints 200 through 228 were used to assign portions of White Mountains and Paiute areas to wilderness.
9. Constraints 090, 097, and 098 prohibited timber harvest in concentrated recreation areas to maintain visual quality and current recreational use.

10. Constraints 93 and 95 provided for ski development to occur only in the Sherwin Bowl area and existing ski areas. All other potential ski areas were available for full-scale timber harvest, as they are under present management.
11. Constraints 017 through 021 proxy the current program output levels for timber, range and recreation.
12. Constraint 095 requires the current fire program to be selected.

04AMC - Maximize Wilderness While Maintaining Current Market Output Levels

Theme: This maximizes wilderness by recommending all Further Planning Areas for wilderness designation. Emphasize maintaining current levels of market outputs through intensive management on those lands outside of wilderness, while producing cost-efficient levels of non-market resources.

Modeling Specifications:

1. Objective function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of OMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.
6. MIRs for visual resources assigned 4,207 acres of suitable timber along State-identified scenic highways to salvage and sanitation. Constraints 031 through 049 set the visual restriction.
7. Wilderness allocations for all Further Planning Areas were assured by turning on appropriate wilderness choices for aggregates 291 through 993.
8. Constraints 016 and 017 set the minimum range and timber production to at least reach the current output levels.

04WLI - Wilderness Emphasis with Capital Investments to Mitigate for Taking Lands Out of Production

Theme: This alternative is designed to evaluate the effects of recommending substantial amounts of quality acres for wilderness. Non-wilderness portions of the Forest are intensively managed to maintain or increase commodity outputs.

Modeling Specifications:

1. Objective function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with Standards and Guidelines, insure that Minimum Management Requirements for wildlife will be met.
6. MIRs for visual resources assigned 4,207 acres of suitable timber along State-identified scenic highways to salvage and sanitation. Constraints 031 through 049 set the visual restriction.
7. Aggregates 582 and 642 were activated to add the White Mountains and Paiute Further Planning Areas to wilderness.
8. Constraints 016 and 017 set the minimum range and timber production to at least reach the current output levels.

ALTERNATIVES CONSIDERED IN DETAIL

04PRF - Preferred Alternative

Theme: This alternative provides a mix of management activities that is sensitive both to historic uses and new opportunities. A mixture of commodity and amenity resource outputs is emphasized. There is no budget limitation.

Modeling Specifications:

1. Objective function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Extended rotation age.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Wildlife diversity constraints on specific analysis areas were applied on 6587 acres of suitable timber lands to provide old growth diversity and provide for up to fifteen pairs of nesting goshawks.
5. Aggregate emphasis 352 and 502 were set to allow all of the Table Mountain and Tioga Lake Further Planning Areas to be recommended for wilderness.
6. Aggregate emphasis 582 and 642 were set and constraints 200 through 228 applied to allow portions of White Mountain and Paiute Further Planning Areas be recommended to wilderness.
7. Constraints 057 through 059 prevent any timber harvest in the Monache area. This reduces conflict with important wildlife, scenic, and dispersed recreation values in the area.
8. Constraint 086 allows for regeneration harvest on 31 percent slopes and greater. This is to maintain these suitable timber lands to be managed as part of the timber component and timber harvest to occur as the stands become economically feasible for harvest.
9. Constraints 081 through 083 exclude concentrated recreation areas from timber harvest to maintain emphasis on a quality recreational experience.
10. Constraints 080, 084, and 085 limit ski area development to current ski areas and 8,000 additional SAOT's. This limit on ski area development is to provide stable community growth as identified in local area community development plans.
11. Constraints 067 through 069 prevent timber harvest on 882 acres in the Laurel-McGee further planning area to protect visual quality, prevent conflicts with recreationists, and protect important wildlife values in the area.
12. Constraints 041 through 053 protect visual quality in the foreground zones of all Sensitivity Level 1 roads and trails; timber is managed only for salvage and sanitation on 6,596 acres under this

constraint.

13. To maintain primitive recreation options by restricting access, constraint 025 removes 245 acres of the Glass Creek area from timber harvest.
14. The tendency of the model to cut large acreages of certain strata in the early decades is leveled by constraints 017, 018, 019 and 021. They average the timber harvest acreage for P6G, L3P, P2S strata, and slopes greater than 31 percent for balanced fuelwood and silvicultural programs.
15. Constraints 018 and 019 force the potential alpine ski areas into a modified timber harvest schedule. This harvest prescription is primarily intended to protect the potential ski option and secondarily to reduce potential timber conflicts with wildlife.
16. Constraints 016 and 017 set the minimum levels for range and timber outputs. The range levels proxy the limitation of livestock grazing on deer winter range and fawning areas. The timber constraint sets the timber harvest schedule at 7.1 MMBF per year. This output level is derived by averaging the first 8 decades timber harvest schedule, and provides consistent harvest levels and silvicultural programs.
17. Constraint 099 requires the current fire funding level, with increased emphasis on suppression.

04CUR Current (1982) Program - No Action

Theme: This alternative displays the current program of management activities on the Forest and projects it over the 50-year planning horizon. The 1982 Forest budget is a limiting factor. The budget remains essentially constant over the planning horizon and continues to be distributed among the resources in roughly the same proportions as in 1982.

Modeling Specifications:

1. Objective function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002, through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.

5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 750 acres (50 acres/pair X 15 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with Standards and Guidelines, insure that population levels of wildlife will be maintained at or above the MMR level.
6. MIRs for visual resources applied 4,207 acres of suitable timber to timber salvage and sanitation management along state-identified scenic highways. Constraints 031 through 049 set the visual restriction.
7. A financial constraint adjusted to equal 1982 funding level.
8. Aggregates 582 and 642 were turned on and constraints 200 through 228 were used to assign portions of White Mountain and Paiute areas to wilderness.
9. Constraints 090, 097, 098 prohibit timber harvest in concentrated recreation areas to maintain visual quality and current recreational use.
10. Constraints 093 and 095 provide for ski development to occur in the existing ski areas and 8,000 SAOTs in potential ski areas.
11. Constraints 017 through 021 proxy the current programs for timber, range and recreation by limiting output to present levels.
12. Constraint 095 requires the current fire program to be allocated.

04 RPA (1980 RPA Program)

Theme: This alternative is designed to meet the targets and goals of the 1980 RPA program, representing moderate to high outputs of commodities and selected amenities. Some of the assigned RPA targets and goals for the Forest are not mutually compatible; where there was a conflict, market outputs (timber, range, and developed recreation) were given priority over nonmarket outputs and amenities. In cases for which RPA goals could not be met in this alternative, they were met in one or more of the other alternatives studied in detail. There is no budget limitation.

Modeling Specifications:

1. Objective functions: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.

- Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply, only in the 6th decade is the yield allowed to decline.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
 5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with standards and guidelines, will insure that MMR population levels of wildlife will be maintained.
 6. MIRs for visual resources applied 4,207 acres of suitable timber to timber salvage and sanitation management along State-identified scenic highways. Constraints 031 through 049 set the visual restriction.
 7. Constraint 070 prevented any new wilderness from being assigned. The Region did have a broad wilderness target under RPA; however, the Forest chose to use RPA as the no-wilderness alternative.
 8. Constraints 016 and 017 require this alternative to meet or exceed specific range and timber output levels. The range target was a progressive increase to meet 55.6 AUMs by the fifth decade. The assigned RPA timber output levels were set as decade harvest levels.
 9. Constraints 021 through 026 allow timber harvest in portions of Deadman and Inyo Craters concentrated recreation areas. These concentrated recreation areas were eliminated in order to meet timber harvest targets.
 10. Constraint 027 prevents scheduled timber harvest in existing ski areas. This is to prevent conflict with current ski area management and to maintain the visual resource quality of the area.
 11. Constraint 030 prevents timber harvest in all concentrated recreation zones other than those listed above. This must occur to reach the assigned recreation RVD target. (Timber harvest in concentrated recreation areas displaces recreation use.)
 12. Constraint 099 requires current fire funding with an increased emphasis on suppression.

04CEE - Maximize Cost Efficiency

Theme: This alternative seeks the most cost-effective mix of land allocations and management practices available on the Forest, given the application of Minimum Management Requirements (MMRs), timber policy constraints (TPCs), minimum implementation requirements (MIRs), and Forest-wide Standards and Guidelines (FS&Gs).

Modeling Specifications:

1. Objective Function: maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Constraints #061 through 064 prohibit regeneration harvest in riparian areas.
5. Constraints #065 through 067 restrict the timber harvest allowed in certain strata identified as nesting areas for goshawks. 450 acres (50 acres/pair X 9 pair) are constrained for goshawks. These acres were sent to timber salvage and sanitation prescriptions. These constraints, combined with the Forest Standards and Guidelines, will insure that MMR population levels of wildlife will be maintained.
6. MIRs for visual resources applied 4,207 acres of suitable timber to timber class III management along State-identified scenic highways. Constraints 031 through 049 set the visual restriction.
7. No additional constraints were needed to meet the theme of this alternative.

04AMN - Maximize All Amenities

Theme: This alternative emphasizes high outputs and protection levels of non-market resources. Fish and wildlife, dispersed recreation, wilderness, and visual resources are maximized with market outputs held at economically efficient levels. There is no budget limitation.

Modeling Specifications

1. Objective Function: Maximize PNV for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).
3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.

4. Wildlife diversity constraints on specific analysis areas were applied on 6,587 acres of suitable timber lands to provide old growth diversity and provide habitat for up to 15 pairs of nesting goshawks.
5. In addition to MIRs, Sensitivity Level 1 and 2 roads and trails were added for a total of 12,237 foreground acres in timber salvage and sanitation.
6. Aggregate emphasis 332, 352, 382, 402, 452, 292, 502, 512, 582, and 642 were set to allow all of Coyote S.E., Table Mountain, Buttermilk, Wheeler Ridge, Laurel-McGee, Horse Meadow, Tioga Lake, Hall Natural, Log Cabin Saddlebag, White Mountains, and Paiute Further Planning Areas to go to wilderness.
7. Constraints 031 through 033 restrict developed recreation to no development of new ski areas or concentrated recreation areas; the only developments allowed are in existing recreational areas.
8. Constraints 050 through 052 prevent scheduled timber harvest in concentrated recreation areas.
9. To maintain high visual quality objectives, constraints 035 through 037 prohibit timber harvest on slopes greater than 31 percent slope.
10. To prevent conflict with key mule deer migration routes, constraints 038 through 040 prevent timber harvest in the Sherwin Bowl area.
11. To maximize the visual, fish and wildlife, and dispersed recreation resources, constraints 089 and 095 prevent scheduled timber harvests in the San Joaquin and Monache areas.
12. Constraint 099 requires the current fire funding level with an increased emphasis on suppression.

04AMB - Emphasize Wildlife and Recreation

Theme: This alternative places a primary emphasis on the quality and quantity of wildlife habitat with a secondary emphasis on moderate expansion of the developed recreation program. Other commodity outputs are produced to the degree compatible with wildlife and recreation objectives. Amenity values other than wildlife receive a moderate degree of emphasis. There is no budget limitation.

Modeling Specifications:

1. Objective function: Maximize PNW for twelve periods.
2. Technical constraints and cutoffs were used for skiing, wilderness, dispersed and developed RVDs, sediment, and wildlife (scheduled output constraints #002 through 015).

3. Timber Policy Constraints:
 - Minimum rotation age at least 95 percent of CMAI.
 - Sustained yield requirements apply.
 - Harvest flow requirements apply.
 - Dispersion requirements apply.
 - Non-declining yield requirements apply.
4. Wildlife diversity constraints on specific analysis areas were applied on 6,587 acres of suitable timberland to provide old growth diversity and provide habitat for up to fifteen pairs of nesting goshawks.
5. Constraints 041 through 053 protect visual quality in the foreground zones of all Sensitivity Level 1 roads and trails; timber is managed only for salvage and sanitation on 7,369 acres under this constraint.
6. Aggregate emphases 332, 462, 502, 522, 582 and 642 were set, and constraints 200 through 228 applied, to allow all of Laurel-Magee, Tioga Lake, Log Cabin Saddlebag, Paiute and portions of Coyote and White Mountain Further Planning Areas to go to wilderness.
7. To minimize conflicts with mule deer migration routes, constraints 084 through 088 located new ski areas to minimize conflict with known deer migration routes.
8. To emphasize range in suitable timber lands, constraint 081 maintains current AUM levels in the Jeffrey pine stands in suitable rangeland.
9. Constraint 080 sends 500 acres of suitable timber lands to minimum management for future recreation development in the San Joaquin area.
10. To optimize wildlife habitat management options and to reduce conflict with mule deer in the Monache area, constraints 038 through 040 prohibit timber harvest in the Monache area.
11. Primarily to provide for high visual quality objectives and for quality recreational experiences, constraints 035 through 037 prohibit timber harvest on slopes greater than 31 percent.
12. To emphasize high quality recreational opportunities, constraints 032 through 035 prevent timber harvest in concentrated recreation zones.
13. Constraints 021 through 024 prevent timber harvest in portions of the Glass Creek area to maintain primitive recreational opportunities and limited access in this area.
14. To minimize conflicts with wildlife, visual resources, and recreational options, constraint 018 allocates much of the San

Joaquin Further Planning Area to modified timber prescription, with extended rotation periods of 150 years.

15. Constraint 016 proxies the removal of livestock from key mule deer winter range, and delayed grazing on key fawning habitat.
16. Constraint 099 requires the current fire funding level, with an increased emphasis on suppression.

Table 10
Constraints Imposed on Alternatives
Considered in Detail

Constraints	Alternatives					
	PRF	CUR	RPA	CEE	AMN	AMB
Objective Function	Max. PNV	Max. PNV	Max. PNV	Max. PNV	Max. PNV	Max. PNV
Timber Policy Constr.						
NDY	yes	yes	6-16	yes	yes	yes
Sustained Yield	yes	yes	yes	yes	yes	yes
Dispersion	yes	yes	yes	yes	yes	yes
MMRs	yes	yes	yes	yes	yes	yes
MIRs	4207	4207	4207	4207	4207	4207
Lvl 1 Rds. & Trls.	2389	0	0	0	1839	1839
Lvl 2 Rds. & Trls.	0	0	0	0	6191	0
Budget Constraint	no	1982	no	no	no	no
Timber Output Constr.	yes	yes	yes	no	no	no
(MMBF cut per.1/5)	7.10/7.10	11.0/13.5	16.8/19.8	0	0	0
Timber Harvest Constr.	yes	yes	no	no	no	no
(Harvest sps. mix)						
P6G strata Ac/Dec.	3500	3500				
L3P strata Ac/Dec.	600					
P2S strata Ac/Dec.	2500					
C.A.S. Tbr. Mgmt. Lands	75.3	80.2	99.2	97.6	61.8	69.8
Acres constrained/key areas						
Potential Ski	708	0	0	0	1966	708
Conc. Rec. Area	3443	5498	5498	0	3443	3443
Monache Area	4512	0	0	0	4512	4512
30-60% Slope	0	0	0	0	20892	20892
Red Fir	7373	0	0	0	0	0
Range Output Constr.	yes	yes	yes	no	yes	yes
Lvstk.AUMs 1-5 dec	40.9/40.9	36/38	41.5/54	0	38/38	40/44
Lvstk.Ac.to Timber	21.9	21.9	43.0	0	6.2	0
Forest Veg. Diversity	6587	0	0	0	6587	6587
Fire Option Constr.	no	yes	no	no	no	no
Fire Program	sup cur	cur cur	sup cur	sup -20	sup cur	sup cur

Table 10 (cont'd)
 Constraints Imposed on Alternatives
 Considered in Detail

<u>Constraints</u>	<u>Alternatives</u>					
	PRF	CUR	RPA	CEE	AMN	AMB
Watershed Improvements Const. Ac./Dec.	yes 5000	yes 400	yes 2000	yes 0	yes 5000	yes 5000
Recmd. Wilderness Const	yes	yes	yes	no	yes	yes
Coyote SE				55.6	55.6	11.8
Table Mtn.	4.1				4.1	
Buttermilk					0.9	
Wheeler Ridge					16.2	
Laurel-McGee				9.1	9.1	9.1
Horse Meadow					5.6	
Tioga Lake	0.9			0.9	0.9	0.9
Hall Natural				5.2	5.2	
Log Cabin-Saddlebag				17.1	17.1	17.1
Benton Range						
White Mtns.	114.7	53.2		251.9	251.9	53.2
Blanco Mtn.						
Birch Creek						
Black Canyon						
Andrews Mtn.					13.6	
Paiute	49.4	54.4			130.6	130.6
Sugarloaf(NV)						
Excelsior(NV)						

OTHER MODELS

This section gives a brief description of the other models used to generate input data for use in FORPLAN and to interpret output data from FORPLAN.

RAMPREP

RAMPREP is a PSW Region Timber Management model that is used to develop timber yield tables. RAMPREP summarizes the potential yields of the Forest based on the Forest 1974 timber inventory. For a detailed discussion of how RAMPREP calculates the potential yields, see The Region Five Timber Inventory Process, July 1981.

Fire Management Analysis Process

The fire management analysis process ^{1/} comprises four levels of analysis and a series of eight computer programs. Of the four levels of analysis, only two (described below) are used in the planning process; the other two levels affect implementation and evaluation. The eight computer programs are simulator report writers used to define the historical and current fire management situations and to evaluate alternative fuels, prevention, detection, and suppression programs.

Fire Management Analysis Level I is basically an analysis of the historical and current fire management situation using fire and weather information, records of fire occurrences, and fire behavior (number of fires, acres burned by fire size and intensity). Some uses of Level I analysis are to:

1. Display the general effectiveness and cost, including FFF, of the current fire management program. This program cost may be used as a basis for estimating expected future costs where the fire program is relatively stable and will not vary significantly between prescriptions on a Forest-wide basis.
2. As a tool to aid the formulation and development of organizations in response to Plan alternatives and prescriptions. Level I analysis identifies areas which can be further analyzed in the areas of prevention, suppression, and fuels management.

Fire Management Analysis Level II is an analysis of various fire management program options (suppression versus prevention emphasis), budget levels (costs), and their effectiveness. This analysis is based upon the simulation of representative fires using varying fuel models, differing suppression resources, historical occurrence patterns, and by changing occurrence patterns based upon prevention efficiency. Some uses of Level II analysis are to:

1. Evaluate fire program options appropriate for the principal Plan alternatives identified by FORPLAN to provide detailed resource output, net value change, and program cost data for selection of the most efficient program level where fire program cost and effectiveness will affect the choice between these alternatives.
2. Evaluate the efficiency of fire program options for a number of Plan alternatives to provide general estimates of fire program cost and consequences.
3. Evaluate the effectiveness of fire program options for a single Plan alternative within a constrained budget to establish the most effective program mix where the budget level is fixed.

^{1/} For a complete description of the fire management analysis process, see FSH 5109.19 (National Fire Management Planning and Analysis Handbook).

From Fire Management Analysis Levels I and II, inputs by alternative to FORPLAN are:

- Various program costs reflecting different fire management organizations,
- Suppression costs reflecting the fire management organizational efficiency, and
- Probability of acres burned.

Then FORPLAN responds by alternative with the following information:

- Acres burned,
- Suppression costs,
- Net resource value change, and
- Optimum organization and budget level by period.

Regional Industrial Multiplier System (RIMS)

The U.S. Department of Commerce's Regional Industrial Multiplier System ^{1/} (RIMS) was used to develop impact multipliers and employment and income estimates for the alternatives analyzed in the EIS. This system provides input-output model multipliers for 56 industrial sectors for Bureau of Economic Analysis (BEA) Economic Area 165 (Los Angeles Area including Inyo and Mono Counties). Most of the economic activity associated with the Forest takes place within BEA Economic Area 165.

Estimates of historical expenditures by sector associated with Forest outputs and purchases from the local economy with the RIMS input-output model multipliers were used to estimate employment and income effects of the alternatives.

A number of assumptions used in the input-output modeling technique must be kept in mind when interpreting the resulting income and employment estimates:

1. Historical transaction patterns associated with Forest outputs and purchases are assumed to hold in the future.
2. Transaction patterns (production functions) for industries in the local economy are assumed to be similar to those in the national economy and are assumed to hold in the future.
3. Income and employment impacts are assumed to occur in the same time period as the underlying changes in Forest outputs and purchases (no lagged effects are assumed).

^{1/} Industry - Specific Gross Output Multipliers for BEA Economic Areas, Regional Economic Analysis Division, Bureau of Economic Analysis, U.S. Department of Commerce, January 1977.

As a result of these basic assumptions, employment and income effects estimated for the alternatives have relatively low reliability in absolute terms in future time periods. However, the income and employment estimates are reasonably accurate indicators of relative changes between the alternatives in the first decade.

Wildlife and Fish Habitat Capability Model

The Habitat Capability Models (HCMs) are a management tool developed by planning biologists in the Pacific Southwest Region. ^{1/} The HCM is a resume of biological information that describes the habitat requirements of a Management Indicator Species.

Although the development of HCMs was related to Forest planning, the models are detailed enough to apply to project work. Therefore biologists and land managers may use this information both for large-scale planning and inventory and for site-specific habitat management within a single stand.

Because these models contain only biological information, they do not imply policy decisions. The tie to policy within the Forest Service will come as each Forest allocates land areas to high, medium, or low capability standards. This will be done in an interdisciplinary manner through the Plan. However, the models provide appropriate information for wildlife biologists in establishing goals for managing habitat quality through project work.

^{1/} Hurley, Janey F. et. al.;
Wildlife Habitat Capability Models and Habitat Quality Criteria for
the Western Sierra Nevada, Stanislaus National Forest, May 1981