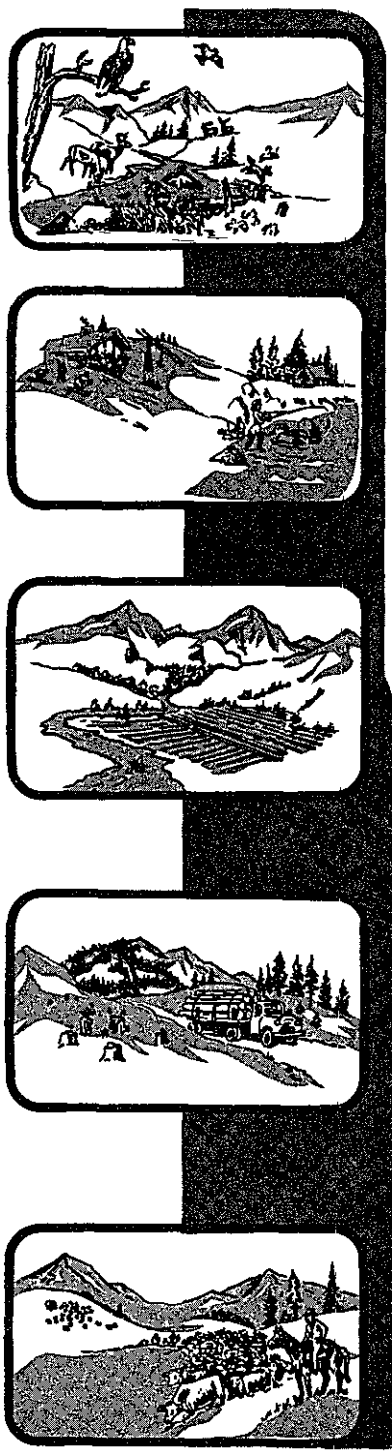
United States
Department of
Agriculture

Forest Service

Delta, Colorado

FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

GRAND MESA, UNCOMPAHGRE, AND GUNNISON NATIONAL FORESTS



RPA

United States Department of Agriculture | Forest Service | Rocky Mountain Region | 11177 W. 8th Avenue Box 25127 Lakewood, CO 80225-0127

Reply to: 1920

Date: JUL 1 1991

Dear Reader:

Enclosed is a copy of the Amended Land and Resource Management Plan for the Grand Mesa, Uncompahgre and Gunnison National Forests. The amended Plan and associated Supplemental EIS have been sent to you because of your interest in the management of the Forests.

The Proposed Plan Amendment and Supplemental Draft Environmental Impact Statement were released for review and comment in August 1989. Since then, we have been busy doing additional analysis and have made many changes in response to the comments and concerns expressed following issuance of the proposed Plan Amendment. We believe this Amended Plan and Final Supplemental Environmental Impact Statement reflect an appropriate level of analysis, considering the complex social, economic and natural resource factors existing within the area of influence for the Grand Mesa, Uncompahgre and Gunnison National Forests.

Because of the complexities noted above, we will not issue a decision on the Amendment of the Grand Mesa, Uncompahgre and Gunnison Forest Plan prior to 30 days following publication of the Notice of Availability in the Federal Register. During this period, we will continue our evaluation of the information and analysis results contained in the documents.

Questions regarding these documents or how we will proceed in the future should be directed to:

"The Plan"
Forest Supervisor's Office
Grand Mesa, Uncompahgre and Gunnison National Forests
2250 Highway 50
Delta, Colorado 81416
303-874-7691

We appreciate your interest in the management of the National Forests.

Sincerely,

Gary E. Cargill

GARY E. CARGILL
Regional Forester

Enclosure: Amended Plan and SFEIS

FINAL

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

FOR THE

AMENDMENT OF THE LAND AND RESOURCE MANAGEMENT PLAN

GRAND MESA, UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

FINAL
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
for the
AMENDMENT OF THE LAND AND RESOURCE MANAGEMENT PLAN
for
GRAND MESA, UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

Delta, Garfield, Gunnison, Hinsdale, Mesa, Montrose,
Ouray, Saguache, San Juan, and San Miguel Counties, Colorado

Type of Action: Administrative

Lead Agency USDA, Forest Service

Responsible Official.

Gary E Cargill, Regional Forester
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P O Box 25127
Lakewood, CO 80225-0127

For Further Information Contact.

R E Greffenius, Forest Supervisor
Grand Mesa, Uncompahgre, and
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Delta, Colorado, 81416
303-874-7691

Abstract The Forest Service, in compliance with the National Environmental Policy Act of 1969 and the Forest and Rangeland Renewable Resources Planning Act of 1974 - as amended by the National Forest Management Act of 1976 - released a Final Environmental Impact Statement for the Land and Resource Management Plan for the Grand Mesa, Uncompahgre and Gunnison National Forest on September 29, 1983.

A Draft Supplemental Environmental Impact Statement (DSEIS) was issued on May 12, 1989 and compared alternatives to a proposed Amendment to the Forest Plan A public comment period of over 120 days followed and over 2,600 individual commentors responded.

The enclosed Final Supplemental Environmental Impact Statement (FSEIS) and the accompanying significant amendment deal with timber management issues Changes in management of other resources such as recreation or wildlife are not proposed Six alternatives were analyzed in detail. Alternative 1A, emphasis on continuation of current direction and also meeting outputs identified in the Forest and Rangeland Renewable Resources Planning Act; 1C, maximizing the economic efficiency of the timber program, 1D emphasizing amenity values and minimizing man's influence in managing the Forest; 1E, meeting the current timber demand and most of the demand anticipated to occur in the next ten years, 1G, emphasizing a timber management program based on sound resource management and public opinion; and 1H, identical to Alternative 1G except for additional aspen harvesting

Alternative 1G is the Forest Service Proposed Action.

Two alternatives analyzed in the Draft SEIS were eliminated from detailed analysis in the Final SEIS, they were 1B which encouraged growth of the timber industry in the area and 1F which emphasized maximizing cash returns to the U.S. Treasury in the next ten years.

PREFACE

This supplement to the Final Environmental Impact Statement (FEIS) was prepared to document the environmental effects of a significant amendment to the Grand Mesa, Uncompahgre and Gunnison National Forests Land and Resource Management Plan (Forest Plan). The FEIS and Forest Plan were issued on September 29, 1983, and presented a long range strategy for management of the Grand Mesa, Uncompahgre and Gunnison National Forests.

In the FEIS and Record of Decision (ROD) for the Forest Plan it was noted that there was a possibility that Continental Lumber Company would build a new stud mill in the near future which could affect the demand for timber from the Forests (page IV-60, FEIS; page 11, ROD) Specifically, the ROD stated, "A review of the local demand situation will be made prior to the end of 1987 to determine if local demand for timber has significantly changed If local demand for timber changes significantly, this Plan will be reanalyzed as required by NFMA Regulations 36 CFR 219.10(c) " (ROD, page II)

Although a new stud mill was not built, Louisiana-Pacific Company built a plant which processes aspen or an aspen-lodgepole pine mix into a product called waferboard The Company desires a supply of aspen fiber from the Forests which exceeds the amount included in the allowable sale quantity in the Forest Plan

The decision to approve the Forest Plan was appealed by several parties under the Forest Service appeal regulations (36 CFR 211 18) Among the appellants was the National Resources Defense Council (NRDC) which represented the Public Lands Institute, The Wilderness Society, the National Audubon Society, the Colorado Open Space Council, the Colorado Mountain Club, the High Country Citizens Alliance, the Western Slope Energy Research Center, the Colorado Wildlife Federation, and the Audubon Society of Western Colorado (Forest Service appeal No. 0944).

Primary issues in the appeal related to the requirements and process used to identify lands suited for timber production including lands economically unsuited for timber production, and the environmental effects of the timber program While the Chief determined that the Plan was in compliance with applicable laws and regulations and that the proposed timber program would not harm the environment, he remanded the FEIS and Plan on September 10, 1984 for further documentation of the timber land suitability analysis and the planned sales level. Then, in accordance with the regulations, on September 12, 1984, the Secretary of Agriculture elected to review the Chief's decision

On July 31, 1985, the Secretary issued a decision on the NRDC appeal which identified a number of areas in the planning process related to the timber program where clarification and additional documentation were needed The Secretary further stated, "My principal concern is that information clearly relevant to making the decision . .be brought forward and made a part of the public record Additional analysis may or may not be necessary " However, the Regional Forester's initial decision to implement the Plan was to remain in effect. (See letters dated September 24, 1984, July 31, 1985, and September 11, 1985 in Appendix C)

Because the analysis of the change of the local demand for timber from the GMUG National Forests and the Secretary's request for more information and possibly additional analysis appeared interelated or complementary the Forest considered the possibility of combining both tasks. The Forest published a Notice "Grand Mesa, Uncompahgre, and Gunnison National Forests Reanalysis of Forest Land and Resource Management Plan" in the Federal Register on October 3, 1986, (51 FR 192) which discussed the potential reanalysis, described the preliminary issues and invited the public to comment

The preliminary issues related to the reanalysis focused on the demand for wood fiber on the Forest, treatment of vegetation including aspen to provide non-timber benefits, and the six aspects of the Secretary's decision. The six aspects are. 1) the economic implications of the timber program, 2) the timber program's contribution to net public benefits, 3) timber cost reduction--revenue enhancement, 4) timber demand, 5) land suited for timber production and 6) "below-cost" timber sales

The issues identified as a result of the public comment included the way in which sensitive scenic areas on the Forest are managed, the level of aspen harvest on the Forest, and the degree to which timber management should play a role in the economic community on the western slope of Colorado.

The Forest Supervisor has determined that this proposed amendment would be significant as described by the implementing regulations of the National Forest Management Act (36 CFR 219.10(f). The implementing regulations require that a significant amendment must follow the same procedures as that required for developmemt and approval of a forest plan These procedures include the 10 step planning process found at 36 CFR 219 12, preparation of an EIS (16 USC 1604 (f), 36 CFR 219 10(f), and 36 CFR 219.12, and determination of the issues, concerns, and opportunities to be addressed in the amendment The issues, concerns, and opportunities will normally concentrate on those issues that have gernerated the need for change (FSH 1909.12, Land and Resource Management Planning Handbook, Chapter 5.32--5.

Public comment on the proposal to amend the Plan and additional analysis indicated that the Management Direction (Plan, chapter 3) and Monitoring Plan (Plan, Chapter 4) would require revision to accommodate the proposed changes, reflect concerns expressed by the public, incorporate national and regional direction, and cover the changes which have occured since the original Plan was issued in 1983

Therefore, this Supplement to the FEIS, and the accompanying significant amendment to the Forest Plan cover the three primary areas discussed above· 1) the analysis of current timber demand as required by the ROD; 2) the Secretary's request for clarification and additional information, and 3) an updated and revised Forest Plan.

TABLE OF CONTENTS

(A detailed Table of Contents preceeds each chapter)

APPENDICES

Summary

SUMMARY
Final Supplemental Environmental Impact Statement For The Amendment To The Grand Mesa, Uncompahgre & Gunnison National Forests Land & Resource Management Plan

This summary is an overview of the Final Supplemental Environmental Impact Statement (FSEIS) for the amended Land and Resources Management Plan (LMRP) *for the Grand Mesa, Uncompahgre and Gunnison National Forests The* purpose of the summary is to highlight key conclusions, and areas of controversy identified during the Amendment analysis. The outline used in the summary follows the general outline used in the FSEIS to facilitate further review of the FSEIS.

I. PURPOSE AND NEED

The purpose of the FSEIS is to analyze and document alternative timber management program levels It is necessary because timber demands have changed significantly and because re-analysis and further documentation of the timber management portion of the original Forest Plan was directed by the Secretary of Agriculture

PLANNING PROBLEMS

Four issues formed the basis of the Amendment analysis

1. **Timber demand.** Timber demand was an issue the Forest had identified in the EIS and ROD The Secretary of Agriculture also directed the Forest to re-examine the demand for timber and other forest goods and services

2 **The USDA decision of July 31, 1985.** The Secretary's decision found that the Regional Forester had not adequately explained his reasons for approving the Forest Plan and that the ROD should have addressed three concerns 1) the rationale for the proposed vegetation management program, 2) efforts to cut costs and raise revenues in the timber management program; and 3) the circumstances under which timber sale levels would be increased during the planning period The Deputy Chief of the Forest Service clarified the Secretary's decision in a letter dated June 23, 1988

3. **Below cost timber sales.** While this issue was discussed in the Secretary's decision, it was also an issue of Servicewide interest and would have been addressed in the analysis regardless of the Secretary's decision

4. **Aspen management.** In the Plan, the concern for aspen was minimal since little aspen management was projected due to low timber demand However, since a new waferboard plant moved into the area which required large volumes of aspen to operate, a concern over aspen management developed.

Public Input and Consultation With Others

Consultation with other agencies, local interest groups, and individuals has been constant throughout the Forest Plan amendment process It has been carried out through notifications in the Federal Register, open house meetings, personal mailings, news releases, and public forums with interested groups (Appendix A of the FSEIS contains a synopsis of public involvement efforts)

Following release of the DSEIS and proposed Amendment to the Forest Plan in May of 1989, a 120-day comment period was held Over 2,700 comments from individuals, organizations, businesses, and other government agencies were received, analyzed and responded to in the final documents

Proposed Changes to the Forest Plan

Based on the analysis as well as public input, the need exists to make the following changes to the Plan

- the location of lands suited for timber management will be changed to more accurately reflect actual on-the-ground conditions This, in turn, will address the issues raised by the Secretary and the public;

- a new Allowable Sale Quantity (the maximum amount of timber that can be scheduled for sale during a 10 year period, or ASQ) has been recommended;

- the Plan's Standards and Guidelines have been updated to reflect current direction, to simplify them and make them easier to read, and to capture the issues generated at the national, regional, and Forest levels,

- the Monitoring Plan has been updated to incorporate current direction and to reflect concerns expressed by the public

- the Management Area allocations have been modified to correct original errors in the 1983 Forest Plan Large scale changes which involve other programs (recreation, range, wildlife, etc) have not been made because they would be outside the scope of the Forest Plan Amendment [process]

II. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

ALTERNATIVE FORMULATION

The original EIS considered nine alternatives. Alternative 1 was selected for Forest Plan implementation (as explained in the 1983 Record of Decision). It provided for the outputs of goods and services to the American people (displayed in Table III-I of the Forest Plan) Since the appeals and subsequent direction for further analysis dealt only with timber management, seven new alternatives were developed during the Plan amendment process, limited in scope to timber management issues.

Alternative 1A

Alternative 1A continues the current timber management direction as prescribed in the Forest Plan approved in September, 1983, which is to maintain or enhance the stability of industries needed to produce local and regional goods and services Alternative 1A is considered to be the "no action" alternative required by the National Environmental Policy Act (NEPA) and represents the "RPA" alternative required by the National Forest Management Act (NFMA).

Alternative 1C

Alternative 1C examines a timber harvest program which harvests only economically efficient timber An economically efficient timber sale is one where the timber revenues and the benefit from water production exceed the costs of the timber sale. The purpose of timber harvesting under Alternative 1C is to provide wood fiber to support local industry only to the extent the program is economically efficient

Alternative 1D

Alternative 1D emphasizes amenity values by promoting non-commodity goods and services. The intent is to stress minimum market opportunities and minimize man's influence in managing the forest, while still meeting most of the historical sawtimber demand levels.

Alternative 1E

Alternative 1E was the Preferred Alternative in the Proposed Amendment published in 1989 and was developed through a series of meetings between environmental groups, timber industry, local & state government and the Forest Service collectively known as the Keystone Process. While it does not have the consent of all parties, it is the result of the Keystone meetings The purpose of timber harvesting under Alternative 1E is to provide wood fiber limited only by the Forest's ability to meet standards & guidelines and maintain the current level of other multiple uses on the Forest.

Alternative 1G

Alternative 1G emphasizes a timber management program based on strong public comment to reduce below cost timber sales, and not harvest in highly scenic areas, while providing for a high level of wood fiber from the remaining lands available for timber management The purpose of harvesting timber under Alternative 1G is to provide high levels of wood fiber and other multiple uses and to help maintain local timber dependent jobs to the extent practical on the Forest's most appropriate commercial timber lands

Alternative 1H

Alternative 1H empasizes a timber management program identical to Alternative 1G except for an additional 630 acres of aspen harvesting annually The additional aspen volume provides increased likelihood that local industry will remain viable in the area at the expense of harvesting timber in the more scenic and expensive areas of the Forest

Alternatives Not Considered in Detail in the Final SEIS

Alternative 1B

While analyzed and presented in the Draft SEIS, further analysis revealed that the high timber harvest levels were not attainable on a sustained basis while meeting Forest Plan standards & guidelines established for sound resource management This alternative emphasized timber market opportunities Timber would be supplied to meet current demand and also encourage future growth in the industry

Alternative 1F

In the Draft, the determination of financially efficient lands was based upon the costs and returns used in the Draft's analysis. In response to public comments concerning fixed and variable program costs, these cost and return assumptions have been updated and corrected. As a result of these changes and at historic price levels, no lands were found to be financially efficient and therefore the alternative was no longer considered

COMPARISON OF ALTERNATIVES

Table S-1 displays the six alternatives and their respective quantifiable outputs, environmental effects, activities and costs

MANAGEMENT AREAS

The Forest Plan identifies management areas on a map Within each management area, a broad range of multiple-use activities can occur In the 1983 EIS, alternatives were made up of different mixes of management area prescriptions This is not the case in the Plan amendment process, where all alternatives have the same mix of management area prescriptions Corrections made to the 1983 Forest Plan management area prescriptions apply to all the alternatives and are based on errors discovered during the amendment process. Table II-5 in the FSEIS displays the acres by management area and the acres of lands suited for timber production in each management area

III. AFFECTED ENVIRONMENT

Chapter III of the original EIS displays the affected environment on the Forest The information that follows in this summary supplements the original information.

BIOLOGICAL DIVERSITY

The Forest has been given the task of managing the Forest for biological diversity while maintaining the multiple-use objectives of the Forest Plan (36 CFR 219 25) Biological diversity includes several biological components· genetic diversity, species diversity, and community diversity

Genetic diversity is the ability to maintain natural genetic diversity in a population of plants and animals, and the ability to maintain a barrier free environment which promotes the genetic exchange of individual species from different geographic areas Genetic diversity has not been affected on a large scale in the Forest.

Species diversity describes the ability to maintain a diversity of plant and animal species Timber harvesting can both increase and decrease species diversity at the same time Even aged timber harvests can increase the species diversity of the larger area as different plants and animals associate with the young stand At the same time the diversity of the young stand is usually less than the original older stand which had a more diverse plant and animal community

Community diversity is the ability to maintain different plant and animal communities at natural levels Timber management can greatly reduce community diversity when it harvests old growth to the point that little remains, or timber harvesting can enhance community diversity when young stands are created in otherwise large blocks of old growth Old growth ponderosa pine is rare on the Forest due to historic mountain pine beetle epidemics and timber harvesting

QUANTIFIABLE RESOURCE OUTPUTS, ENVIRONMENTAL EFFECTS, ACTIVITIES AND COSTS BY ALTERNATIVE

TABLE S-1

OUTPUT/EFFECT	UNITS	1A	1C	1D	1E	1G	1H
SUITED LANDS BY SPECIES							
Spruce/fir	Acres	274,807	255,899	128,135	419,864	216,717	216,717
Ponderosa pine	Acres	9,365	796	14,946	76,481	74,730	74,730
Lodgepole pine	Acres	52,354	30,906	20,389	100,244	89,366	89,366
Aspen	Acres	25,972	281	36,733	284,534	169,318	241,153
TOTAL	Acres	362,498	287,882	200,203	881,123	550,131	621,966
ASQ BY NON INTERCHANGEABLE COMPONENT (NIC)							
Sawtimber	MCF/Yr	7,000	4,359	3,666	6,874	4,667	4,667
Conifer POL	MCF/Yr	0	0	0	610	610	610
Aspen POL	MCF/Yr	875	0	616	5,217	3,700	4,620
High Cost Aspen POL	MCF/Yr	0	0	0	1,800	150	980
Sawtimber	MBF/Yr	31,500	19,600	16,500	31,000	21,000	21,000
Conifer POL	MBF/Yr	0	0	0	2,400	2,400	2,400
Aspen POL	MBF/Yr	3,500	0	2,400	20,900	14,800	18,500
High Cost Aspen POL	MBF/Yr	0	0	0	7,200	600	3,900
TOTAL	MCF/Yr	7,875	4,359	4,282	14,501	9,127	10,877
	MBF/Yr	35,000	19,600	18,900	61,500	38,800	45,800
LONG TERM SUSTAINED YIELD	MCF/Yr	11,277	9,354	7,869	23,840	14,083	15,833
	MBF/Yr	50,070	41,532	34,938	105,850	62,529	70,299

TABLE S-1 (continued)

OUTPUT/EFFECT	UNITS	1A	1C	1D	1E	1G	1H
ACRES TREATED BY SILVICULTURAL METHOD IN DECADE ONE							
CLearcut:							
Aspen	Acres/Yr	310	0	489	2,797	1,376	2,006
Lodgepole pine	Acres/Yr	1,186	0	0	733	733	733
TOTAL	Acres/Yr	1,496	0	489	3,530	2,109	2,739
Shelterwood.							
Spruce-fir	Acres/Yr	6,600	6,091	0	7,308	4,551	4,551
Ponderosa pine	Acres/Yr	486	0	0	667	667	667
TOTAL	Acres/Yr	7,086	6,091	0	7,975	5,218	5,218
Selection.							
Spruce-fir	Acres/Yr	0	0	3,092	0	0	0
TOTAL - ALL METHODS	Acres/Yr	8,582	6,091	3,581	11,505	7,327	7,957
WATER							
Baseline Yield	M AC FT/Yr	2,866	2,866	2,866	2,866	2,866	2,866
Yield Above Baseline	M AC FT/Yr	13 1	7 5	1 0	17 4	11 1	12 4
FACILITIES							
New Local Road Construction	Miles/Yr	24	11	9	41	24	29
Local Road Reconstruction	Miles/Yr	25	15	10	39	23	26
UNROADED AREAS Percentage of RARE II Areas Planned for Entry, Decade One	%/Decade	3 2%	8.6%	3.8%	10 9%	4.7%	5 4%
PRESENT NET VALUE (150 YEARS @ 4% Discount Rate)							
Direct Timber	$MM	-20 559	-11 324	-13 690	-41 600	-22,869	-27 871
Water Above Baseline	$MM	17 268	12 540	983	26 523	16,291	17,438
TOTAL TIMBER RELATED	$MM	-3 291	1 216	-12 707	-15 077	-6,578	-10 433

TABLE S-1 (continued)

OUTPUT/EFFECT	UNITS	1A	1C	1D	1E	1G	1H
RETURNS TO TREASURY Decade One, Timber Only	$MM/Yr	.194	192	095	323	194	222
PAYMENTS TO COUNTIES FROM 25% GROSS RECIEPTS Decade One, Timber Only	$MM/Yr	173	119	102	259	168	.187
CHANGES IN EMPLOYMENT & INCOME		*	*	*	*	*	*
NET TIMBER RECIEPTS First Decade First 50 Years	$MM/Yr $MM/Yr	-1 140 - 695	-.585 - 361	- 597 - 547	-1 822 -1 572	-1 040 -.835	-1 253 -1 029
BUDGET COST Operational Costs Capital Investment Costs TOTAL COST	$MM/Yr $MM/Yr $MM/Yr	939 891 1.830	625 437 1 062	684 323 1 007	1 338 1 518 2 856	885 827 1 711	995 1 007 2 002
TIMBER RELATED COST Fixed Timber Cost Variable Timber Cost Road Construction Cost TOTAL TIMBER COST	$MM/Yr $MM/Yr $MM/Yr $MM/Yr	160 779 891 1 830	.160 .465 .437 1 062	160 524 .323 1 007	160 1 178 1 518 2 856	160 725 .827 1 711	160 835 1.007 2 002

Legend.
MCF/Yr - Thousand Cubic Feet of woodfiber per year
MBF/Yr - Thousand Board Feet of woodfiber per year
$MM/Yr - Millions of 1982 Dollars per year

* - Changes in jobs and income require more explanation than is appropriate in Table II-6 See Table II-10 and the employment & income discussion beginning on page II-38

FOREST VEGETATION

Human management has influenced the vertical and horizontal diversity of the timber stands on the Forest.

Most aspen stands are naturally "even-aged and lack vertical diversity Self-regenerating aspen generally exhibit some vertical diversity Conifer invaded aspen stands contain the highest degree of vertical diversity. During the past 70-100 years aspen stands have been protected from fire and generally have not been logged. As a result the aspen on the Forest has progressed into a more homogeneous and less diverse vegetative mosaic than would occur naturally.

Vertical and horizontal diversity in conifer stands varies according to both the vegetation type and structural stage. Naturally occuring spruce-fir stands exhibit high levels of vertical diversity while lodgepole pine presents low levels. Generally clearcutting and shelterwood cutting result in even-aged stands which contribute to horizontal diversity and selection harvesting results in uneven-aged stands which contributes to vertical diversity

Old-growth forests are an important part of the ecosystem Currently no extensive old-growth inventory exists, partially because no clear definition of old-growth exists However, many of the biological characteristics are found in the older-aged trees for which data is available Although the age of a stand should not be used as a sole criteria for assessing the old growth potential of the Forest, age can provide a good indication of the relative abundance of old-growth on the Forest

TENTATIVELY SUITED TIMBER LANDS

Approximately 42% of the Forest (1,253,541 acres) is classified as tentatively suited for timber production.

Aspen management was a key issue in the Amendment analysis During original Plan development, 489,593 acres were identified as commercial aspen lands which is similar to being tentatively suited for timber production (Table F-3 of the Amended Forest Plan). Due only to the lack of a commercial market, 462,183 of these acres were originally considered not suited for timber harvests

In response to the increased commercial demand and interest in aspen management, the new suitability analysis identified 345,785 acres of tentatively suited aspen

TIMBER FINANCIAL & ECONOMIC EFFICIENCY

Financially efficient timber stands are those from which the estimated total receipts equal or exceed the direct timber costs A financial analysis of all tentatively suited timber lands found that no stands were financially efficient at historic average prices

Economically efficient timber stands are those from which the timber revenues plus the value of water production benefits equal or exceeds the direct timber costs. Nineteen percent of tentatively suited timber lands were found to be economically efficient. All economically efficient timber stands are Englemann Spruce/Subalpine Fir stands

TIMBER DEMAND

There are 27 wood processing mills which purchase timber from the Forest. The two largest mills, (Louisiana Pacific and Blue Mesa Forest Products) account for 46% of the current local demand.

Table S-2 displays current timber demand as well as an estimate of the next ten years average demand, which includes growth in the industry. Recent (1989, 1990) sawtimber harvest levels are approaching expected future demand levels

TABLE S-2 **TIMBER DEMAND** (Demand on the GMUG only)

(MMBF)	*Past 5 Years	Estimated Current Demand	Expected Future Demand
Sawtimber	21,000	21,000	29,600
Aspen POL**	11,600	28,800	31,000
Conifer POL	1,300	1,300	4,400
TOTAL	33,900	51,100	65,000

* Aspen POL historic harvest level does not reflect industries' demand because of appeals and settlement agreements which held offerings at a lower level
** 90% aspen 10% lodgepole pine

CLIMATE

Earth's climate is affected by the amount of carbon dioxide in the air Vigorous forests take more carbon dioxide out of the atmosphere and put more oxygen into the atmosphere than do slower growing forests The over all vigor of timber stands on the Forest is declining Timber harvesting with the accompanying regeneration of new stands of vigorous trees would enhance the Forest's contribution to the oxygen/carbon dioxide balance

SOILS

The Forest's role is to conserve soil by minimizing soil damage from various ground disturbing activities The Forest has rated soils for bare soil erosion hazard as low, moderate, or high Most soils on the Forest fall into the low to moderate erosion hazard The hazard ratings allow the Forest to consider whether to use the more expensive erosion control methods on moderate to high erosion hazard soils or not to do the project.

Large areas of the Forest have experienced and continue to experience slope movements. The amount of slope movement appears to be directly related to weather The wetter the year, the more the slope moves During the last 80 years very few, if any, major slope failures can be attributed to Forest Management

Forest soils possess moderate to moderately high fertility compared to the rest of the region. The most productive zone is in the aspen vegetation type on the western half of the Forest, which are resilient and revegetate relatively easily The least fertile soils occur above 11,000 feet and between 6,000 and 7,000 feet

AIR QUALITY

Air quality over most of the Forest is good The main source of pollutants from Forest activities are suspended particulates from wildfire and prescribed burning. Future energy related developments and associated population growth in the area are expected to have a detrimental effect on air quality over the Forest

WATER

During the Amendment process the Forest analyzed the ability to produce additional water through; 1) clearcutting in lodgepole pine and aspen; and 2) shelterwood harvests in spruce/fir and lodgepole pine. These additional water flows were considered in determining the economic efficieny of commercial timber sales The demand for additional water production was determined to exceed the capability of the Forest to supply water Water production was valued at $34.14 per acre-foot (1982 dollars)

State water quality standards are met by 95% of the water flowing from the Forest Water not meeting state standards has been polluted by toxic metals from past mining activities, by natural sediment from the "Muddy" country around Paonia, and by short-term sediment from isolated unstabilized recently constructed roads

RANGE

The effect of timber harvesting at the proposed levels on available forage for grazing both livestock and big game is considered insignificant. While such effects, especially in aspen, can be significant on a site specific basis, the effects usually deal more with short term transitional forage increases, disruptions in historical distribution patterns, temporary changes in animal preference patterns, temporary increases in human and mechanized equipment activity, and changes in livestock and big game management techniques

The current permitted livestock grazing capacity is 340 MAUM's, but estimated livestock use is expected to decrease to 250 MAUM's by the year 2000 As a note of reference, the total actual use in 1989 was 267 5 MAUM's

ROADLESS AREAS

Approximately 950,000 acres of the Forest are currently roadless Three former RARE II areas have been specifically mentioned during public involvement as sensitive areas These areas include the Kannah Creek, Tabeguache and Roubideau RARE II areas. RARE II recommended all three areas as suitable for wilderness in 1979, and the 1980 Colorado Wilderness Act released all three areas for nonwilderness management.

ROADS

The Forest contains slightly less than 4,000 miles of road on the Transportation System Inventory Approximately 9% have been physically closed but will remain on the inventory for possible future resource management needs FSEIS Table III-7 displays the miles of open and closed roads on the Transportation System Inventory by Ranger District

VISUALS/SCENERY

The Forest contains a great variety of landscapes which are visible from many viewer locations. Most landscapes contain unobtrusive signs of human activity About one-half of one percent of the Forest's landscapes are dominated by signs of past or present human activity.

RECREATION OPPORTUNITIES

Dispersed recreation is the only element of the recreation program affected by the alternative proposals addressed in this FSEIS When projected dispersed recreation demand and potential capacity are considered, the Forest provides ample dispersed recreation capacity to meet reasonable expectations of future use.

There are a number of areas on the Forest where semi-primitive recreation opportunities are limited or highly valued Examples include the Tabeguache and Roubideau roadless areas, Kebler and McClure passes, the base of Mount Sneffels range, and the Silver Jack area. In these areas, the potential for Forest user conflicts appears to be greatest

FISH AND WILDLIFE

An important objective of wildlife habitat management on the National Forests is to maintain and/or enhance the diversity of habitats This objective serves the long-term goal of maintaining viable populations of all native species on the Forest

The structural makeup of a particular plant community (vertical diversity) and the overall makeup of numerous plant communities within a large geographical area (horizontal diversity) contribute to the level and mix of species richness on the Forest A forest ecosystem which provides a variety of vegetation structural stages in proper distribution, size, and diversity is one that will furnish habitat for the greatest number of wildlife species.

Big Game

The opportunities to increase the carrying capacity for deer and elk through a commercial timber sale program on the GMUG are minimal While many more animals do live on the GMUG during the summer months, the Forest's ability to provide year-round habitat is limited to the winter range capacities Current elk and deer populations are at or above the winter range capacities.

RIPARIAN

In general, the riparian areas on the Forest vary considerably in diversity, stratification and condition Based on historical data, the condition of these riparian systems appears to range from fair to good These conditions can be affected by the association between the riparian system and the timber sale unit

AQUATIC RESOURCES

In general, timber harvesting activities have the potential to affect fisheries habitat by degrading water quality and increasing sediment as a result of road construction, skid trails, culvert placement, site access, road encroachment, and removal of riparian vegetation

THREATENED AND ENDANGERED SPECIES

The Endangered Species Act of 1973 requires all Federal departments and agencies to conserve threatened and endangered species.

The bald eagle is presently the only threatened or endangered animal species which may have regular, year-around occurrence on the Forest, however, *summer occurrence is rare The hedgehog cactus does occur on the Forest with* known locations identified

FOREST INSECTS AND DISEASE

The most prevalent insect pests on the Forest are the Engelmann spruce bark beetle, the mountain pine beetle, and the Western spruce budworm. Serious outbreaks of these pests have occurred in the past

Dwarf mistletoe continues to be a problem, predominantly in lodgepole pine but to a lesser degree in ponderosa pine

Timber harvesting or thinning can reduce the chance of an insect or disease outbreak occuring, by increasing the vigor and resistance of either new stands or nearby trees

WILDFIRE

Fire occurrence on the Forest is cyclic in nature due to drought cycles Generally, during drought years natural fuels present a high fire hazard and create a high probability of having fires larger than 1,000 acres on the Forest

ECONOMIC SETTING

The unemployment rate in Economic Impact Areas 214 (western half of the Forest) and 215 (eastern half) had increased since the original analysis. The unemployment rate in EIA 214 has increased from 4 8% in 1983 to 8 6% in 1990, similarly the unemployment rate in EIA 215 has increased from 3 9% in 1983 to 5 7% in 1990

IV. ENVIRONMENTAL CONSEQUENCES

Environmental consequences (or effects or impacts) occur when ecosystems are changed, whether through management action or inaction. Under each alternative, we would manage the forested lands in a different way In this chapter, we present the known environmental consequences of those different management alternatives

Implementation of the alternatives is not likely to affect the geologic material, topography, or the geomorphic processes taking place on a massive scale

BIOLOGICAL DIVERSITY

Effects on Genetic Diversity

The alternatives would not have a significant effect on genetic diversity.

Effects on Species Diversity

Timber harvesting in spruce-fir favors englemann spruce over subalpine fir and so reduces vegetation species diversity. Timber harvesting can have either a positive or negative effect on wildlife species diversity When harvests are made in large blocks of mature timber stands that cover an entire watershed, new kinds of communities are created and wildlife diversity increases as a result

Alternative 1E would provide the greatest increase in wildlife species diversity, and the greatest decrease in spruce-fir species diversity. Alternative 1D would provide the smallest increase in wildlife diversity and have the least effect on spruce-fir species diversity. Alternatives 1G, 1H, 1C, and 1A would have an intermediate effect

Many large, mature, even-aged blocks of lodgepole pine now exist on the Forest, timber harvesting would increase species diversity in these stands.

Lodgepole pine stands would provide the least wildlife species diversity under Alternative 1D and the greatest under Alternative 1E. Alternative 1E would harvest about one-third of the Forest's lodgepole pine. Old growth values would be concentrated in unmanaged lodgepole stands in all the alternatives during the next 150 years

Alternatives 1C, 1A, and 1D would manage less than 10% of the Forest's aspen and provide relatively low levels of aspen wildlife species diversity. Alternative 1G would manage about one-third of the Forest's aspen and provides a moderate level of aspen maintenance Alternatives 1H and 1E create relatively high levels of aspen maintenance. None of the timber management alternatives would maintain aspen on the Forest at present levels without the aid of wildfire, disease, or large-scale noncommercial aspen treatments. Even Alternative 1E would, at most, affect one-half the conifer-invaded aspen on the Forest

Old growth in ponderosa pine is rare on the Forest as a result of both timber harvesting and mountain pine beetle epidemics Additional harvests would reduce wildlife species diversity, but could increase resistance to future mountain pine beetle epidemics No timber harvesting could mean greater reductions in wildlife species diversity than timber management would create

The alternatives present two different methods of maintaining wildlife species diversity through old growth retention in ponderosa pine. The first method calls for very little management and assumes that the mountain pine beetle would cause fewer reductions in diversity than timber harvesting The second method calls for a high level of timber management and assumes that timber harvesting would cause fewer reductions in diversity than the mountain pine beetle would. Alternatives 1C, 1A, and 1D favor the "do very little" approach while alternatives 1G, 1H, and 1E favor the "high level of timber" approach

Without proper road closures the overall wildlife diversity of many species --- especially those which are intolerant of human activity --- would decrease in all these forested habitats

Effects on Community Diversity

The alternatives would enhance community diversity in aspen, lodgepole pine, and spruce-fir through timber management All of the alternatives maintain a significant portion of the three timber types in an unmanaged condition where old growth would be emphasized

Old growth Ponderosa pine communities are rare on the Forest, and have generally been logged or killed by the mountain pine beetle The two methods of maintaining ponderosa pine wildlife species diversity discussed above also apply to maintaining ponderosa pine community diversity Neither method is known to be the best way of maintaining diversity on the Forest.

Logging would not occur in the "10A" or "10C" management prescriptions which identify unique ecosystems.

FOREST VEGETATION

Forest timber management activities can affect the species composition, density, vertical structure, health, vigor (growth), yield, and age of the Forest The effects of the alternatives due to timber management activities are often directly tied to the number of acres on which the activities take place This section will discuss the effects of Forest management activities on diversity in both aspen and conifer forests

Table S-5 ranks the alternatives according to the potential to most strongly affect vertical and horizontal diversity.

TABLE S-5 **Alternatives**

	1A	1C	1D	1E	1G	1H
Vertical Diversity*	3	1	2	6	4	5
Horizontal Diversity**	5	6	4	1	3	2

* 1 - Least decrease; 6 - Most decrease
** 1 - Most increase; 6 - Least increase

Need for Mitigation

All management activities must be designed to meet minimum plant diversity standards. These standards assure vegetative stability as well as a wide array of structural stages on the Forest. These are necessary to meet the needs of a variety of wildlife speces. Some of these standards include:

- Maintain or create a minimum of 20% vertical diversity within a diversity unit
- Maintain or create a minimum of 30% horizontal diversity within a diversity unit.
- Provide a Patton edge index of 1.4 and at least a medium edge contrast

Old Growth

Any alternative which harvests the mature to over-mature timber stands would result in a decrease in the amount of old growth habitat on the Forest On the Forest as a whole no alternative would decrease old growth habitat below the level needed to maintain viable populations of those species which depend on old growth.

Need For Mitigation

All management activities must be designed to meet old growth standards in order to assure that adequate habitat exists to maintain viable populations of all existing vertebrate wildlife species on the Forest.

Cumulative Impacts

As time proceeds, the lands suited for timber production would assume the structure of managed stands with interspersed unharvested areas. As natural stands are altered by timber harvest, the diversity of tree and understory vegetation age classes would increase in certain watersheds, although the diversity on specific sites would decrease.

CLIMATE

Scientists now think that removal of large areas of forest vegetation can have an effect on the oxygen/carbon dioxide balance, on local climate, and even on global climate. None of the alternatives considered in this EIS call for harvesting trees on anywhere near that scale

SOILS

The effects of timber management on the soil resource can include changes in chemical, biological, and physical characteristics It is generally believed that over time these alterations stabilize, usually with no major impact to overall site productivity (Geppert, Lorenz, and Stone).

Alternatives 1E and 1H could cause a concentration of harvest in certain watersheds, which, in turn, could result in increased erosion and loss of slope stability. Both Alternative 1E and 1H include road construction on steep slopes The risk of erosion and slope failure would be higher for these alternatives due to on these steep slope acres.

Alternative 1G would reduce conifer harvesting and increase aspen harvesting The planned aspen harvest is spread throughout the Forest, and no significant impacts are expected on the soil resource. Also, no significant impacts to the soil resource are anticipated for Alternatives 1A, 1C, or 1D if harvesting is dispersed

Cumulative Impacts

The only recognized cumulative effect of timber harvest on soils is the potential for reduction of soil productivity on sites that are repeatedly disturbed Recurring activity in timber stands may not allow for the natural breakup of compaction or may prevent the soils from revegetating and establishing protective cover Those alternatives which rely more heavily on silvicultural methods that require periodic re-entry of a stand (shelterwood) as opposed to a single entry harvest method (clearcutting for example) would have the greatest potential to cause these cumulative effects However, the mitigation practices would effectively maintain soil productivity in all harvest sites.

Need For Mitigation

Soil and water protection measures for the various multiple use activities can be found in the Forest Standards and Guidelines, in Chapter III of the Forest Plan Additional measures can be found in the Regional Soil and Water Conservation Handbook

Protection measures specific to timber management and road building include

Timber Management -

- Identification of sensitive soils and slope situations through the use of soil survey information, geologic information, or other related hazard-type data

- Avoiding the identified sensitive areas if at all possible If these sensitive areas are impossible to avoid, special measures would be designed and implemented to lessen adverse impacts on the areas

- Careful planning and layout of the skid trail system in advance of the logging activity This would take into consideration the road system, landing locations, topography, and sensitive areas A well planned skid trail system, in theory, would minimize the area of disturbance and provide for a more efficient and less costly operation.

- The creation of log landing and decking areas would be minimized and scarification would be limited

- Setting goals to keep overall disturbance to a minimum and accomplishing this through close administration of contracts and compliance monitoring

- Evaluating soil moisture conditions before and during activities and curtailing the use of heavy equipment during extremely wet situations when soil is most susceptible to damage.

- Using erosion control practices during the activity and immediately after its conclusion, as they are needed to protect all resource values involved

Roads -

- Careful planning and design to fit the road to the landscape and to fit the road for the anticipated level and season of use
- Avoiding problem areas such as flood zones, narrow canyon bottoms, wet areas, and highly erodible or unstable soils.
- Locating roads well away from streams, both perennial and intermittent, whenever possible and crossing streams only at right angles
- Designing appropriate drainage features to prevent water from concentration on either the road surface or unstable fresh soil.
- Keeping the vegetative clearing limits to the absolute minimum needed for the road right-of-way
- Depositing surplus soil and rock in designated areas where the runoff would not reach water bodies or streams
- Maintaining proper inslope, outslope, or crown and reshaping grade dips
- Using erosion control practices during new construction with follow-up monitoring to assure that the measures work

AIR QUALITY

All of the alternatives may temporarily affect local air quality by creating dust and smoke However, fine particulates resulting from road dust would not have a significant effect on air quality on the Forest or within the region

Smoke would result from slash burning for site preparation and from burning to reduce fire hazard. Burning would be scheduled to meet weather conditions that would maximize dispersal

WATER YIELD

For all of the alternative timber management programs, timber harvest would increase the amount of water flowing from National Forest lands

Alternative 1E has the most potential to create additional water (17,400 acre feet per year) while Alternatives 1D (1,000 ac ft/year) and 1C (7,500 ac ft/year) would produce the lowest increases.

For all the alternative timber management programs, the increased water yields generally would be spread out over the entire runoff cycle. Decreases in fall water yields are not expected. Peak discharges are not likely to effect properly maintained ditches with diversion structures that have been designed to withstand normal variation in peak discharges. Mitigation, if necessary, can be achieved through timely ditch maintenance and diversion structure design and management.

Alternatives 1E, 1G, and 1H would not increase the cumulative water yield increase for the suitable timber acres more than six percent A six percent increase is within the acceptable limits of 10 to 20 percent conversion of a drainage area to an equivalent clearcut area that is recommended for sensitive C classification watersheds (HYSED, October 1981, page 45) Significant water yield increase impacts are not expected for Alternative 1G, but the emphasis on aspen harvest in Alternatives 1E and 1H could cause a concentration of harvest in certain watersheds This concentration of harvesting would increase the risk of channel damage and degradation in sensitive watersheds.

WATER QUALITY

Sediment is the primary pollutant created by logging and road construction activities on the National Forests. Increased water temperature is a secondary concern. As water temperatures increase beyond 70-degrees Fahrenheit, the cold water fisheries resource would be detrimentally affected.

Although the alternatives do vary with regard to their effects on water yield, water temperature, and sediment production, our analysis, indicates that none of the six alternatives would result in a significant adverse impact to water resources

Need For Mitigation

Detailed conservation requirements and practices for all Forest streams are included in the Forest Standards and Guidelines

RANGE RESOURCES

Created openings and road construction can affect livestock distribution in both positive and negative ways. In some cases, man-made openings through the forest make trailing and movement of livestock from one pasture to another easier. However, livestock (primarily cattle) may also develop new habits as a result of clearings in the forest which may make herding/trailing/gathering more difficult

In sum, the effects of the alternative timber management programs are to vary the acreages of aspen clearcutting and create a temporary increase in the amount of forage available to livestock The miles of road built to reach the stands also vary by alternative and would have indeterminate effects on the distribution of livestock

Alternatives 1E (2,791 acres) and 1H (2,000 acres) schedule the greatest number of acres of timber cutting in aspen, as well as the highest road consturction mileages. Consequently, these alternatives have the greatest potential to of temporarily increase forage available to livestock. Alternatives 1A, 1C, and 1D would have the least potential to increase forage, with annual aspen harvests at 310 acres for 1A, none for 1C, and 489 acres for 1D The proposed alternative, 1G, would provide a moderate number of acres available for forage (1,370 acres)

Need For Mitigation

Make openings of sufficient size and number within a given area to keep the density of browsing in openings to a level that would assure adequate regeneration.

Provide for adequate structures such as cattleguards and wing fences where permanent timber sale roads may have a negative effect on livestock distribution

ROADLESS AREAS

The roadless character of an area is lost when road construction occurs

The Alternatives were analyzed to determine the effect each would have on sensitive roadless areas (Kannah Creek, Roubideau, or Tabeguache). None of the Alternatives would require entry into the Kannah Creek Area for timber cutting. Alternatives 1A and 1E would enter both the Roubideau and Tabeguache areas for timber harvesting purposes as displayed in Table S-7 below. Table S-7 identifies how all roadless areas would be affected by each of the alternatives.

TABLE S-7

EFFECTS OF ALTERNATIVES ON ROADLESS AREAS (1st DECADE)

Alternative	Roadless area acres affected by proposed timber sales	Estimated # of roadless areas to be impacted	% of roadless areas impacted by proposed timber sale	Total acres entered in Roubideau	Total acres entered in Tabeguache
1A	3,009	11	3.2	349	1,067
1C	2,132	8	2.3	0	0
1D	1,253	5	1.3	0	0
1E	10,242	26	10.9	1,100	1,286
1G	4,485	20	4.7	0	0
1H	4,808	21	5.1	0	0

VISUALS/SCENERY

Every management activity which alters the landscape through vegetation and soil manipulation or by introducing structures would affect visual resources. The extent of the effect would ultimately be determined by how well the treatment blends with the surrounding landscape.

The VQO's would be the same for all alternatives of the Forest Plan. However, the amount of visual change from the present visual condition would be greatest in alternative 1E and 1H; moderate for alternatives 1A and 1G; and least in alternatives 1C and 1D.

Need For Mitigation

Each management activity on the Forest, especially timber management and road construction activities, must be designed to meet the Visual Quality Objectives for the area in which the activity occurs. Each project must conform to the Standards and Guidelines described on pages III-7 through III-9 of the Forest Plan.

RECREATION OPPORTUNITIES

The effects analysis focuses on the effects of the timber management alternatives on dispersed recreation. The developed recreation, downhill skiing, and wilderness recreation programs are unaffected by the range of alternatives evaluated in this final SEIS and remain unchanged from the 1983 Forest Plan.

Timber harvesting and the associated road building usually result in a modified environment which falls into the Roaded Natural or, rarely, the Urban Recreation Opportunity Classes. Acres which are currently roadless or have a very low density of roads may be classed as Semi-primitive Non-motorized or Semi-primitive Motorized. Timber harvesting would result in a change of the ROS class to Roaded Natural. In some cases the semi-primitive classification of some areas could be maintained following harvesting if special precautions were taken in planning of harvest activities and if roads were closed and obliterated following the harvest.

The number of acres in the primitive ROS category remains the same for all alternatives. "Back country" use, now being satisfied in semi-primitive areas, may be concentrated in the remaining primitive and semi-primitive areas. This would reduce the quality of the back country experience for the user.

Semi-Primitive (both Motorized and Non-Motorized) opportunities change among the alternatives. Alternative 1E would create the largest loss of semi-primitive acreage with an estimated decrease of 5%. Alternative 1H would have the next largest loss in acreage in semi-primitive with an estimated decrease of 4%. These decreases would include losses in sensitive areas such as Kebler Pass corridor, Dallas Divide, Cimarron (area west of Silver Jack Reservoir) and McClure Pass. Alternatives 1A and 1G would create an estimated loss of 3% and Alternatives 1C and 1D would create an estimated loss of 2%.

Changes in acreage among Recreation Opportunity Classes from the current direction to the projected alternative direction should meet the projected demand in all demand categories.

Need For Mitigation

Each management activity, specifically timber management and road construction projects, would be planned and designed to meet the physical setting criteria for each Recreation Opportunity Spectrum Class and its associated Visual Quality Objectives. Each management activity would conform to the Standards and Guidelines.

WILDLIFE AND FISH

Commercial timber management activities can affect the Forest's wildlife and aquatic resources by reducing, changing, or improving their habitat conditions, or by displacing individual animals.

Providing a mix of structural stages is important for both habitat diversity and species richness. At the same time, timber harvesting will reduce the amount of old growth on the Forest.

Table S-1 displays the average annual level of timber harvest and road construction by alternative for the first decade. Those alternatives which harvest the most mature timber acres would have the most adverse impact on those species which depend on mature or old growth stands, while those which are attracted to the younger stands, edge component or are in need of forage would be most positively affected.

Habitat for elk and deer is greatly influenced by open roads and the composition of forage and cover. Table S-1 lists the miles of road construction and reconstruction by alternative. Those alternatives with the most miles of road construction per year also have the greatest potential to keep more roads open and would have the most negative impact on big game habitat effectiveness.

Elk and deer movements and their presence can be influenced by human activities. Those alternatives which treat more acres and build more roads, as displayed in Table S-1, have the most potential to displace big game to private lands.

RIPARIAN

The direct effects of timber harvesting within the riparian ecosystem would be minimal because of the limited amount of harvesting which occurs in the riparian zone.

Road construction has a more critical and long lasting impact on riparian zones than any other management activity (Hoover and Wills, 1984) The incremental sediment contribution from roads is often many times that from all other land management activities, including log skidding and yarding (Yee and Roelofs 1980). Table S-1 displays the miles of road construction and reconstruction by alternative. Those Alternatives with the most miles of road construction and reconstruction would have the greatest effect on riparian areas

Need For Mitigation

- Within diversity units 5% or more should be in old growth and 5% should be in the grass forb structural stages
- In forested ecosystems, a minimum of 50% of the diversity unit would be maintained as hiding cover
- Manage road use to provide for habitat needs of indicator species; this would include road and area closures
- Close all newly constructed roads to public motorized use unless a documented analysis shows a need and the road does not adversely impact other resources.

AQUATIC RESOURCES

The type of timber harvested (aspen or conifer), the location of the sale unit within the watershed, and the location of roads and culverts associated with the sale unit would cause varying degrees of potential risk to the aquatic resources

General ranking in terms of potential impacts to the aquatic system

HIGH		*MODERATE*			*LOW*
1E ------>	1H ----->	1G ----->	1A ------>	1C ----->	1D

Of all the alternatives considered, Alternative 1E would have the greatest potential for adversely affecting the aquatic resources This is due primarily to increased water yields, possible sedimentation, and the relative percentage of the timber base scheduled for cutting.

Need For Mitigation

- Locate roads and trails outside riparian areas unless alternative routes have been reviewed and rejected as being more environmentally damaging.
- Maintain at least 80% of existing plant density within 100 feet of the edges of all perennial streams, lakes, and other water bodies, or to the outer margins of the aquatic/riparian ecosystem where that ecosystem is wider than 100 feet

THREATENED AND ENDANGERED SPECIES

Although any management activity has the potential to affect threatened and endangered species, compliance with the Endangered Species Act and the consultation processes on a case by case basis would assure that there would be no adverse effect to these species under any of the alternatives

FOREST PEST MANAGEMENT

The alternatives with higher ASQ levels offer the greatest opportunity to provide a lower risk for insect attack Alternatives 1A, 1E, 1G, and 1H would contain both *ponderosa pine and lodgepole pine as components of the ASQ. All alternatives* offer spruce-fir in the ASQ which would provide the opportunity to treat stands over the long run to reduce the potential for spruce beetle epidemics.

Need For Mitigation

Pest outbreaks that threaten Forest users and/or resources inside or outside of *visually sensitive areas would be suppressed. Methods that minimize visual* resource degradation would be emphasized

WILDFIRE

The probability of wildfire occurring on the Forest is influenced by weather, topography, the availability of fuel, and sources of ignition Timber harvesting (and associated activities) can produce large quantities of residue in amounts and distribution which provide fuel for fires, or preclude effective fire protection, for a number of years Timber management activities also can increase the likelihood of wildfire ignition by bringing equipment and people into the forest who otherwise might not be there

Alternatives with the highest ASQ levels create the most short-term fire potential as a result of a buildup of logging residues At the same time these alternatives *also decrease the long-term fire potential by reducing fuels created by dead and* dying trees

Need For Mitigation

Mitigation of the impacts on the fire environment can be accomplished by controlling the risk of human-caused fires and by reducing hazardous residues *from management activities where those residues constitute a problem*

ECONOMICS

A major factor in determining changes in local jobs and income is whether or not the local waferwood plant remains in the area. If the local waferwood plant closes, the Delta-Montrose area would lose approximately 353 jobs and $5 9 million in employee income The relative risk of the waferwood plant closing ranked from low risk to high risk is· Alternative 1E, 1H, 1G, 1D, 1A and 1C

Many timber mills process sawtimber, therefore the sawtimber industry will still exist even if one or more sawtimber mills close Timber harvesting from 1985 to 1989 was greatest in 1989 when 27 MMBF were harvested from the Forest. Using 1989 as a base, Alternatives 1A and 1E may allow sawtimber related jobs to expand by 53 and 46 jobs respectively. Alternatives 1G, 1H, 1C and 1D may *reduce sawtimber related jobs by 69, 69, 85, & 121 jobs respectively.*

SOCIAL ENVIRONMENT

The degree of change from current or historic output levels and/or change in the character of the Forest has a potential influence on the social environment Some alternatives propose relatively large changes. The alternatives proposing the *largest changes would have the greatest potential impact.*

Alternatives 1E, 1G, and 1H increase timber production and therefore create relatively more roads, modified conditions, and change on the Forest. Each of these alternatives tends to support or strengthen communities and lifestyles *dependent upon logging and lumbering Roaded recreation opportunities would* be enhanced However, the expectations and preferences of people who desire a more aesthetic or pristine experience from the Forest may not be met

Alternatives 1A, 1C, and 1D provide for decreased timber production and/or do not provide enough aspen POL to maintain existing industry The principal change is one of reduced emphasis on timber and decreased livelihoods based on Forest resource use Recreation based on more natural settings is featured

SIGNIFICANT CUMULATIVE EFFECTS OF THE ALTERNATIVES

On the GMUG National Forests the possibility of additional significant cumulative effects occuring because of the interaction of forest management activities with activity on adjacent lands is greatly mitigated by terrain and topography. The topography of the Forest is such that movement of materials between the Forest and adjacent lands is restricted Movement of materials is largely confined to the atmosphere and to one-way transference of materials in streams and rivers flowing from the Forest onto adjacent lands.

The prevalent cumulative effect on National Forest System Lands is sedimentation and the resulting effects on aquatic productivity The quantity and quality of roads, skid trails, and mechanized site preparation treatments would determine the cumulative effect of Forest vegetative management on sedimentation. To mitigate potential cumulative effects the Forest will·

- Use Prescriptions, Forest and General Direction, and Standards and Guidelines to address the "quality" of construction and harvest (Stednick, 1987)

- Disperse timber harvest throughout planning watersheds rather than concentrating it in order to address the "quantity" of activities focused in a watershed at a given point in time

As winter ranges on private lands continue to decrease in quantity and quality, summer range on the Forest becomes more important The treatment of timbered summer range lands through both commercial and non-commercial methods, inconjuction with effective road closures, would provide big game animals with additional food and thermal conditions This, in turn, would put the animals in a better condition before they arrive on those winter ranges

Timber harvesting and roadbuilding would take place but would not result in significant removal of nutrients from the environment The use of identified silvicultural methods would protect sites from nutrient loss Additionally, guidelines proposed in the Forest Plan provide direction to ensure that all of the activities associated with timber and road construction provide necessary mitigation measures to protect the Forest resources Monitoring and evaluation are a part of the Forest Plan implementation process Monitoring requirements can be found in Chapter IV of the Forest Plan

Precedent-Setting Developments On The Forest

Scheduling of commercial timber sales in currently roadless areas would occur in all Alternatives

Sensitive or fragile areas examined during the planning process on the Forest include threatened and endangered habitat, winter range, unstable soil areas, wetlands, and riparian areas No precedent setting activities would take place in these areas

Change Over Large Areas Or Long Periods Of Time

The proposed timber management program would result in increased management of the aspen forests. This would include development of additional roads

There would be a reduction in the amount of old growth coniferous forests Areas would be identified in diversity units that would be managed for old growth in adequate quantity to meet wildlife needs

Wildlife Habitat

The proposed timber management program would alter the mix, arrangement, and internal characteristics of the aspen plant community on the Forest Continuous changes in the aspen communities would have an effect on winter range and might improve forage conditions for big game animals on transitional ranges.

Although no wildlife species are known to be totally dependent upon an aspen community's structural stage or interspersion, several species heavily use various structural stages for their daily activities including foraging, thermal, and security cover

Certain habitats such as old growth, may be reduced. Management objectives for diversity include the recognition of the need to increase the abundance of early succession stages in the Forest types.

Even-aged management practices would create more edge effect over the Forest

CONFLICT WITH PLANS/POLICIES OF OTHER AGENCIES

The alternatives are compatible with the State Comprehensive Outdoor Recreation (SCORP) Plans written by Colorado Planning Agencies

The Colorado Department of Wildlife has developed long-range population goals for managing wildlife populations on the Forest. No alternative would prevent these overall population goals from being met

There are no significant conflicts with U S. Fish & Wildlife Service recovery plans for threatened and endangered species as required under the Threatened and Endangered Species Act

A variety of federal, state, and local government plans and policies relate to concerns about water quality. Each concern relates to a potential for conflict

None of the alternatives are expected to cause serious conflicts with any water related plan or policy

A potential conflict exists with adjoining National Forest and National Parks that are responsible for managing designated Class I Wilderness Areas. Smoke from prescribed burning on the Forest could affect Class I areas by contributing to regional haze which could affect visibility for short periods of time

Counties have a variety of policies relating to commercial use (i e. oil and gas operating or log hauling) of county road systems Some policies may increase the cost and permit requirements for a purchaser of Forest products

A variety of federal, state, and local agency plans and policies encompass the GMUG None have been found to be in conflict with the alternatives proposed in this FSEIS

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irretrievable commitments resulting from implementation of the proposed alternative include lost production or lost use of renewable resources due to the passage of time The opportunity to use a renewable resource is foregone during the time that it is committed to other uses or during periods of non-use

RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

- Those Amendment alternatives that propose higher ASQ levels than the original Plan would have more acres under timber management This would accelerate the replacement of existing, slow-growing, or stagnated stands of trees with younger, faster growing stands that would increase long-term timber production.

UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Implementation of any alternative would result in some adverse environmental effects that cannot be avoided. Standards and guidelines and mitigating measures are intended to keep the extent and duration of these effects within acceptable levels, but adverse effects cannot be completely avoided

Areas of potentially significant adverse effects

- Intermittent decrease in air quality due to dust from road construction, maintenance, and use and from smoke due to prescribed burning.
- Short-term and local increases in soil erosion and stream sedimentation due to land disturbing activities
- Short-term changes in the landscape from silviculture and road construction that may be disturbing to Forest visitors
- Disruption of prehistoric or historic evidence of man's occupation of the Forest.
- Elimination of small areas from vegetation production due to construction of permanent physical developments such as roads
- Increased conflicts between recreation use and other land use activities related to commodity production.
- Solitude loss due to increased management and use in certain areas
- Temporary wildlife disturbance in some locations because of increased human activity

I. Purpose and Need

I. PURPOSE AND NEED

TABLE OF CONTENTS

FIGURES

CHAPTER I

PURPOSE AND NEED

This supplement to the Final Environmental Impact Statement (FEIS) was prepared to document the environmental effects of an amendment to the Grand Mesa, Uncompahgre and Gunnison National Forest Land and Resource Managment Plan (Forest Plan) The FEIS and Forest Plan, issued on September 29, 1983, presented a long range strategy for management of the Grand Mesa, Uncompahgre and Gunnison National Forest The Notice of Availability appeared in the Federal Register on October 14,1983

Since that time now issues have been raised and some conditions have changed These can best be resolved by amending the Forest Plan

DEVELOPMENT OF THE FOREST PLAN/NEW CIRCUMSTANCES

BACKGROUND

The Draft Environmental Impact Statement and Proposed Land and Resource Management Plan for the Grand Mesa, Uncompahgre and Gunnison National Forest had received 324 public comments when the comment period closed on February 19, 1983 (FEIS, p VI-3)

Among the comments was a letter from the Continental Lumber company indicating that it was considering building a sawmill and planer mill in Montrose, Colorado (FEIS, page IV-60, comment 8, page VI-104) Continental indicated its concern that the " .annual sales program be rescheduled to reflect more total management of the timber resource An annual sale of 55-60 MMBF saw logs would alleviate the constrictions of timber resource supply and allow justification of the large capital expenditures required to establish a modern process facility." At the time that the Forest Plan and FEIS were ready to be issued, Continental had not yet firmed up plans for construction of a mill and had not invested in a potential mill site.

Because of the uncertainity about the construction of a new mill, the Regional Forester decided to issue the FEIS, Forest Plan, and Record of Decision without acting on Continental's request for an increase of 20 million board feet (MMBF) in the Allowable Sale Quantity (ASQ) In the Record of Decision (ROD) for the Land and Resource Management Plan, the timber management program was described, and a provision made for industry expansion, as follows:

- Three hundred fifty million board feet of timber will be offered for sale during the period 1984 through 1993. To respond to local interest in accelerating the timber harvest schedule, 35 MMBF will be offered in 1984, and 55 MMBF will be offered annually in 1985 through 1987 A review of the local demand situation will be made prior to the end of 1987 to determine if local demand for timber has significantly changed. If local demand for timber changes significantly, the Plan will be reanalyzed as required by NFMA Regulation 36 CFR 219 10(f). If local demand has not significantly changed, the remainder of the 350 MMBF planned for the decade will be offered in 1988 through 1993 at a rate of 25 MMBF annually. Any of the volume offered but not sold in the first 4 years will be available for re-offer (ROD, page 11)

Although Continental Lumber Company eventually decided not to build the sawmill and planer mill, the Louisiana Pacific Company (LP) did construct a mill in Olathe to produce waferwood. Instead of the conifer sawtimber which would have been required by the Continental mill, the waferwood process uses aspen as the principal species. The needs of LP for aspen greatly exceeded the amount of aspen wood fiber that was included in the ASQ for the Forest Plan. Subsequent study did establish that demand for timber from the National Forest had significantly changed.

APPEALS OF THE FOREST PLAN

After the Plan and EIS were released, the documents were appealed under the Forest Service administrative appeal regulations (36 CFR 211.18) These regulations allow interested persons or groups to request a review of a Forest Officer's decisions by a higher level authority Because the Record of Decision was signed by the the Rocky Mountain Regional Forester, the decision to implement the Grand Mesa, Uncompahgre and Gunnison National Forest Plan was reviewed by the Chief of the Forest Service. In such cases the Chief of the Forest Service may affirm or reverse the Regional Forester's decision or may instruct him to conduct further action, such as elaborating or pursuing additional study (36 CFR 211.15).

The parties that appealed the Regional Forester's decision to implement the GMUG Forest Plan were the State of Colorado, John Swanson (an individual), the Natural Resources Defense Council (NRDC) acting on behalf of the Public Lands Institute, the Wilderness Society, the National Audubon Society, the Colorado Open Space Council, the Colorado Mountain Club, the High Country Citizens Alliance, the Western Slope Energy Research Center, the Colorado Wildlife Federation, and the Audubon Society of Western Colorado

The State of Colorado objected to the Forest Plan because of concerns over the level of proposed increase in timber sales and related issues. The appeal included a perception that the Plan lacked adequate rationale, adequate consideration of alternative methods of maintaining a healthy forest (particularly aspen stands), and adequate consideration of recreation and wilderness. This appeal was withdrawn May 31, 1984 through an agreement between the executive director of the Colorado Department of Natural Resources (DNR) and the Regional Forester As a result of this agreement, the Forest Supervisor amended the Forest Plan on July 30, 1986 to include a recreation appendix. The Director of the DNR and the Regional Forester also agreed to increase cooperation and coordination on issues of water quality monitoring, cultural resources, aspen management, and pest management.

Mr. Swanson objected to the proposed Forest Plan because he felt that the Plan and FEIS violated federal laws mandating that the fundamental purpose of the National Forest Service was preservation and that every unit should be "established as an actual *Preserve* ..." and that " 2,235,000 acres be included in the National Wilderness Preservation System "

His appeal was denied by the Forest Service Chief on April 5, 1984 on the grounds that ". .managing the National Forest as a preserve does not meet the multiple use management policy of Congress .the additional acreage you request was determined not suitable for wilderness and is considerably more than Congress directed for wilderness study." Mr. Swanson did not pursue the matter further.

On September 29, 1983, the Natural Resources Defense Council (NRDC) appealed the proposed Forest Plan. In December 5 of the same year NRDC filed a statement explaining the reasons for their appeal They argued that.

1 The Plan contemplates an ambitious, expanded timber program;
2. The Plan has failed to identify lands which are economically unsuited for timber production;
3. The Plan's ambitious timber program will be environmentally as well as economically harmful, and
4 The Plan was formulated in violation of the law.

NRDC asserted that because of the issues they identified the Plan had to be reformulated under proper procedures.

The Chief and Secretary of Agriculture's Findings on NRDC Appeal

In the matter of the NRDC appeal, the Chief of the Forest Service determined that the Plan was in compliance with applicable laws and regulations and that the proposed timber program would not harm the environment. However, he remanded the FEIS and plan on September 10, 1984 for further documentation of the timber land suitability analysis and the planned sales level. Then, on September 12, 1984, the Secretary of Agriculture notified the Chief that he intended to review the Chief's decision on the NRDC appeal.

On July 31, 1985, the Secretary issued a decision which identified a number of areas in the planning process (related to the timber program) where clarification and additional documentation were needed He supported the Chief's conclusion that the regulations complied with NFMA and that the process followed by the Regional Forester to determine suitability was consistent with 36 CFR 219 12 The Secretary returned both Plans, however, and required the following actions be conducted.

Investigate options for reducing timber costs and/or enhancing timber revenues,

Supplement the record with information on timber demand projections,

Make the results of a financial efficiency analysis of tentatively suited timberlands part of the FEIS for public review;

Discuss the economic implications of proposed timber sales which would cost more to prepare for sale than they would produce in terms of revenues to the U S Treasury,

Explain the assumption that a timber sale program is the most appropriate way to maintain a healthy forest; and

Explain the overall public good to be attained by increasing community dependency on the Forest's timber program by offering below-cost sales that rely on uncertain federal funding

Further, in a September 11, 1985, letter, the Secretary stated, "My principal concern is that information clearly relevant to making the decision be brought forward and made a part of the public record Additional analysis may or may not be necessary." However, the Regional Forester's initial decision to implement the Plan was to remain in effect (See letters dated September 24, 1984, July 31, 1985, and September 11, 1985, Appendix C)

AMENDMENT PREPARATION

The Forest published a Notice, "Grand Mesa, Uncompahgre, and Gunnison National Forests, Reanalysis of Forest Land and Resource Management Plan," in the Federal Register on October 3, 1986, (51 FR 192) This Notice discussed the potential reanalysis, described the preliminary issues, and invited the public to comment

NRDC and the groups it represented as well as local individuals and groups known to be interested in the Forest's management were contacted and made aware of the study Several meetings were held to discuss the reanalysis and the tentative issues which had been identified

A review of the public's comments as well as a study conducted during late 1986 and early 1987 indicated that adjustments to the Forest Plan should be considered and that the adjustments could constitute a "significant" amendment under the regulations which implement the National Forest Management Act (36 CFR 219)

A Notice of Intent to prepare a significant amendment to the Grand Mesa, Uncompahgre and Gunnison National Forest Land and Resource Management Plan was published in the Federal Register on December 30, 1987 (52 FR 250). The Notice reported the results of the scoping and analysis to that date and identified four preliminary issue areas: 1) USDA decision of July 31, 1985, 2) Below-cost timber sales, 3) Timber demand, and 4) Aspen management. Also included in the Notice was a schedule of meetings to be held to "inform the public and encourage public participation in the Forest Plan amendment process." The meetings were held in Montrose, Norwood, Delta, Grand Junction, Gunnison, Paonia, and Denver, Colorado.

Public response at that time showed many opposing and conflicting views of appropriate land management strategies for the Forest In order to reduce polarization and achieve a better understanding of these views, the Forest Service hired the Keystone Center (a non-profit organization specializing in working with opposing parties with resource management concerns) to facilitate discussions on issues and processes related to a Forest Plan amendment. A letter from the Keystone Center dated June 2, 1988, invited interested individuals and groups to participate in the process. The letter stated, "The role of the Keystone Center is as a neutral, third party mediator Our responsibility is to help the parties design a process, to discuss issues of mutual concern, facilitate the meetings, be available to transmit ideas and perceptions between the parties and the Forest Service, and to serve where appropriate as a sounding board." The invitation was accepted by the timber industry, local government officials, and several environmental groups. A paper prepared by Keystone documents the results of these discussions and is in Appendix A

Through the Keystone process we clarified and focused the issues to be considered in detail in the environmental analysis (see "Issues" later in this Chapter). We also brought to light a new component of the analysis--the need to revise and update the Management Direction (Plan, Chapter III) and Monitoring Plan (Plan, Chapter IV). The Keystone process resulted in a number of agreements, one of which was to include development of a revised Monitoring Plan in the proposed Forest Plan amendment.

The Keystone process **did not** achieve its primary goal of helping the opposing parties reach a consensus on an appropriate timber sale level for the Forest

The Draft Supplemental EIS and the Proposed Plan Amendment were released to the public on May 12, 1989 The public comment period extended through September 25, 1989 Since that time we have been preparing the final version of these documents; this Chapter 1 is a part of that final version

PURPOSE AND NEED FOR AND SCOPE OF THE PROPOSED AMENDMENT

The Supplement to the FEIS and the accompanying Amendment to the Forest Plan address the three principal needs discussed above : 1) the analysis of current timber demand as required by the ROD, 2) the Secretary's request for clarification and additional information; and 3) an updated and revised Forest Plan

During original Plan development, seventeen Forest-wide Planning Questions (now known as Planning Problems) were developed and used throughout the planning process to help establish and evaluate the alternatives. In the development of the proposed Forest Plan amendment, the following four issues formed the basis for the new Planning Problems.

1. Timber demand. As previously explained, this was an issue the Forest had identified in the EIS and ROD. The Secretary of Agriculture also directed the Forest to re-examine the demand for timber and other forest goods and services

2 The USDA decision of July 31, 1985. The Secretary's decision found that the Regional Forester had not adequately explained his reasons for approving the Forest Plan and that the ROD should have addressed three concerns. 1) the rationale for the proposed vegetation management program; 2) efforts to cut costs and raise revenues in the timber management program, and 3) the circumstances under which timber sale levels would be increased during the planning period. The Deputy Chief of the Forest Service clarified the Secretary's decision in a letter dated June 23, 1988

3 Below cost timber sales. While this issue was discussed in the Secretary's decision, it was also an issue of Servicewide interest and would have been addressed in the analysis regardless of the Secretary's decision.

4. Aspen management. In the Plan, the concern for aspen was minimal since little aspen management was projected due to low timber demand. However, since a new waferboard plant moved into the area which required large volumes of aspen to operate, a concern over aspen management developed.

The original *Planning Question 8* asked: "how should forest products be managed to supply commercial and non-commercial demands on the Forest?" As a result of this original planning question and the public comments received during the draft comment period, the following six supplemental Planning Problems resulted:

Planning Problem 8A: Identify the demand for wood fiber and multiple-use benefits on the Forest.

Planning Problem 8B: Determine whether commercial timber sales or non-commercial methods or a combination of the two would produce the needed multiple-use benefits (other than timber benefits) in the most economically efficient manner.

Planning Problem 8C: Determine whether a "healthy forest" is necessary to produce needed multiple-use benefits and whether vegetation treatment is necessary for a healthy forest

Planning Problem 8D: Determine if it is appropriate for the Forest to continue a below-cost commercial timber sales program Determine what the impact on *local community economic stability would be with this type of program "due to* uncertainties over a continuation of a relatively high level of federal funding to support a timber program with costs greater than revenues" (USDA Decision).

Planning Problem 8E' Determine if only financially efficient lands should be identified as suited for timber production, or if economically efficient lands should also be included. Decide which lands that are neither financially or economically efficient should be considered and why

Planning Problem 8F: Determine how aspen should be managed on the Forest How much aspen should be provided as a wood fiber source? Is it appropriate and/or necessary to harvest aspen to maintain the species?

Three other original Planning Questions are affected by the Plan Amendment; these are·

Planning Problem 2 Determine how many roadless and/or highly sensitive scenic areas would be entered as a result of the proposed timber harvest level

Planning Problem 10 Determine how much additional water would be produced above naturally occurring levels, what those benefits would be in the first decade, and what the discounted benefits would be over the 150 year planning horizon.

Planning Problem 17 Determine the area that would be maintained with a visual quality objective of retention/partial retention as a result of timber harvesting.

These planning problems helped the Forest develop supplemental alternatives and then analyze the effects of the alternatives

Scope of Proposed Plan Amendment

Based on the considerations discussed in this chapter, the scope of the proposed plan amendment was narrowed to these points:

- a new Allowable Sale Quantity (the amount of timber that is scheduled for harvest during a 10 year period, or ASQ) will be determined in response to new demand created by a new wafer board mill at Olathe, and as the result of more complet analysis of Forest capability on suitable lands, consistent with standards and guidelines for all resources;

- the location of lands suited for timber management will be changed to more accurately reflect actual on-the-ground conditions. This, in turn, will address the issues raised by the Secretary and the public;

- the Plan's Standards and Guidelines will be updated to reflect changes over the past five years, to simplify and make them easier to read, and to capture the issues generated at the national, regional, and Forest levels,

- the Monitoring Plan will be updated to incorporate national and regional direction and to reflect concerns expressed during the analysis,

- the Management Area allocations will be modified to correct errors, incorporate direction received over the past five years, and to conform to the new analysis Large scale changes which involve other programs (recreation, range, wildlife, etc) are not being made because they would be outside the intended scope of this Forest Plan Amendment.

THE SIGNIFICANT ENVIRONMENTAL ISSUES

The Forest Service is responsible for determining the significant environmental issues deserving of study and for de-emphasizing insignificant issues. (36 CFR 1501 (d))

This chapter discusses the issues raised in the appeals of the Forest Plan and the Chief's decision in each case. The direction from the Secretary of Agriculture to the Chief upon review of the appeals is also discussed. The major issues underlying the questions that the Regional Forester was directed to reanalyze and explain to the public are discussed above under "Scope of the Proposed Amendment"

Related to the question of balance is the concern that timber sales will damage the environment Issues of particular significance for the Forest resources were.

Maintenance and Distribution of Old Growth

Many individuals value old growth trees and older forests for maintenance of diversity and site productivity, for protection of watersheds, and for aesthetic and recreational purposes This issue includes the trade-offs between conserving old growth for its benefits to wildlife habitat and ecosystem diversity as well as its recreational and aesthetic value, and continuing timber sales to support present and future demands for timber The issue is compounded by the lack of a widely-accepted definition of old growth For some, the definition is bound by biological and botanical factors For others, the essence of old growth is its spiritual or aesthetic dimension

Biological Diversity

The biological diversity issue reflects increasing concern over species extinctions, reductions in the genetic richness within species, simplification of ecological systems, and the environmental, social, and economic impacts of these problems

Wildlife Habitats

People are very concerned that the Forest be managed to provide suitable habitats for wildlife of many species Big game is an essential contributor to local economy. Other forms of wildlife offer opportunities for consumptive and non-consumptive use that is deeply seated in the value systems of many National Forest users. People like wildlife and want to see it considered in management decision making

Recreation Opportunities

People are concerned that a wide variety of options for recreation be available on the Forest Some see a potential conflict between timber sales and dispersed non-motorized recreation as well as the resulting effect upon tourism Conversely, others are concerned that the effects of providing more and additional recreational opportunities may result in reduced timber sales that may affect the economic stability of nearby communities.

Visuals

Many people expressed concern that the beauty of the Forest would be diminished by activities associated with timber sales. Many people find changes in the natural setting objectionable and argue that most or all areas should be maintained in a natural character. This concern is particularly acute in viewsheds, those landscapes seen from areas that are heavily used by the public such as roads, rivers, or developed recreation sites. The quality of the scenic resources are important to the local tourist industry in communities that are attempting to diversify their economic base.

Roadless Areas

Respondents expressed strong disagreement on the future of roadless areas Timber interests argue that removing land and timber sales from the timber base for undeveloped recreation is unnecessary and unjustified They expressed a belief that the opportunities provided by wilderness, wilderness study areas, and the roadless areas that would not be affected by logging would be sufficient to meet future demands Other individuals argue that roadless opportunities are dwindling as new roads are built in previously undeveloped areas and that all existing undeveloped areas should be retained for future generations. Some expressed concerns over specific roadless areas of the Forest.

Water Quality

Appellants and some respondents to the draft amendment and the supplemental EIS were concerned that activities associated with timber sales, such as road building, would have a detrimental effect on water quality by creating increased erosion Some felt that valuable nutrients would be removed from the soil and would thus delay regeneration of the species removed Concern was also expressed that fish and wildlife habitat would be damaged.

The public raised additional questions and issues of lesser significance or relevance to the scope of the proposed amendment Chapter VI of this document displays comments received and the Forest interdisciplinary team responses

FOREST PLANNING DECISIONS

In 1975 the Congress of the United States created the National Forest Management Act and required development of a long-term plan for the management of every National Forest and National Grassland Each plan was to be called a "Land and Resource Management Plan," and was to specify certain types of decisions The types of decisions are summarized in the Chief of the Forest Service's decision letter (August 31, 1988) on an appeal of the Flathead National Forest Land and Resource Management Plan. These are

1. Forest multiple-use goals and objectives, including an identification of the quantities of goods and services that are expected to be produced [CFR 219.11 (b)].

2. Multiple-use prescriptions and associated standards and guidelines for each management area on the Forest, including proposed and probable management practices [36 CFR 219.11 (c)].

3 Identification of land that is suitable for timber production. (CFR 219.14).

4. Determination of the allowable sale quantity for timber and the associated sale schedule (36 CFR 219.16) Allowable Sale Quantity (ASQ) is a term used to describe the maximum amount of timber that may be sold in any year

5. Monitoring and evaluation requirements (36 CFR 219.11)

6. Project and activity level decisions if they are specifically identified in the Record of Decision and LRMP and are disclosed for NEPA purposes in the FEIS

The Forest Plan provides direction to manage the Forest to produce goods, services, and use opportunities in a way that creates the highest long-term net public benefits. It is not a plan for the day-to-day administrative activities of the Forest. In the remainder of this document, we will refer to the Land and Resource Management Plan simply as the "Forest Plan" or the "Plan."

The proposed amendment is a "programmatic action" describing the Forest-wide direction of the timber program and developed by a Forest Service interdisciplinary team composed of specialists in the natural and social sciences and the environmental design arts. The names and qualifications of the members of the interdisciplinary team are listed in Chapter V of this SEIS.

The Two-Step Planning Process

The **first step** in the land management planning process is the Forest Plan, which determines land allocations and provides requirements for site-specific decisions. The **second step** is the analysis of individual projects, which includes applying the standards and guidelines from the Forest Plan to site-specific activities.

Project-level decisions require site specific environmental analysis Common project-level decisions related to this amendment include whether or not timber will be harvested and, if so, in what way. An environmental analysis document, such as an environmental impact statement or environmental assessment, would precede these decisions unless they are categorically excluded from documentation Project-level planning provides an additional opportunity for public participation.

To avoid repetitive discussions this document is "tiered" in places to the original Final Environmental Impact Statement prepared for the Forest Plan in September 1983 "Tiering" means that this document serves only to clarify and expand on the information in the Plan and the FEIS. Much of the information included in the FEIS will not be repeated in the Supplement unless it is necessary to the understanding of discussion and display of analysis results. The places in which this amendment or SEIS revises information or direction in the Plan or FEIS are noted in the text

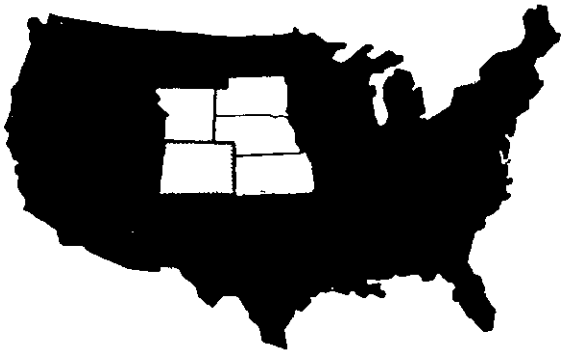
The proposed amendment is in accord with the requirements of the laws, regulations, executive orders and direction of the Chief of the Forest Service as described in the preface to the Forest Plan.

VICINITY OF THE FOREST

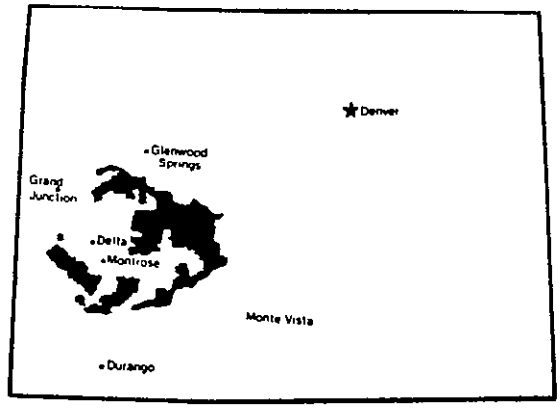
An overview discussion of the Forest is contained in the FEIS, Chapter I, pages 7-10. There has been no change in this information up to the present time. Figure I-1 is a vicinity map displaying land administered by the Forest. Chapter III of the FEIS and Chapter III of this FSEIS contain a fuller description of the affected environment and of changes that have occurred since the Plan was approved in September 1983.

FIGURE I-1
VICINITY MAP

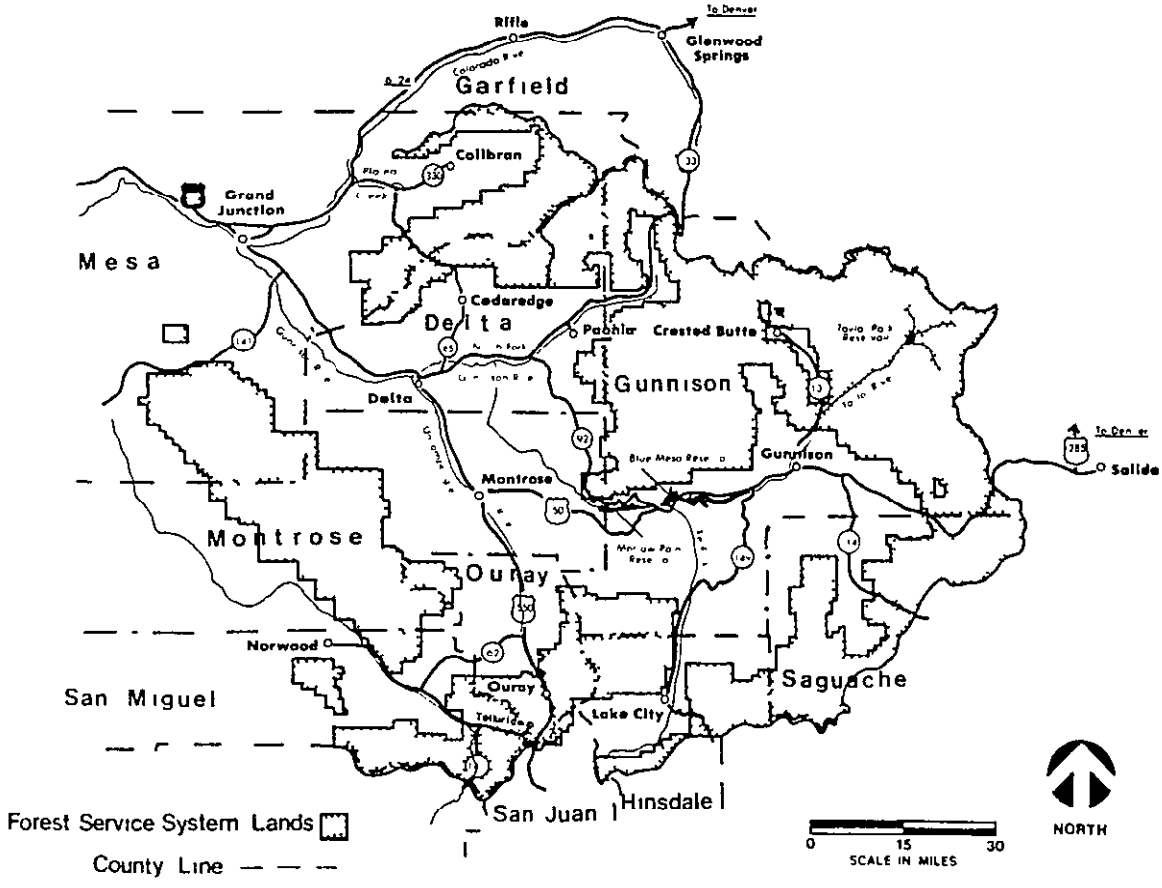
Region 2 Forest Service,
United States Department of Agriculture

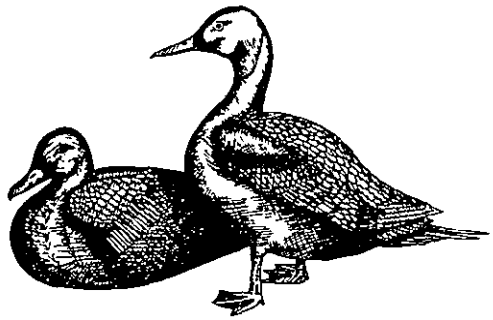


The State of Colorado



Grand Mesa, Uncompahgre & Gunnison National Forests





II. Alternatives Including the Proposed Action

II. ALTERNATIVES INCLUDING THE PROPOSED ACTION

TABLE OF CONTENTS

FIGURES

TABLES

CHAPTER II

ALTERNATIVES INCLUDING THE PROPOSED ACTION

INTRODUCTION

Chapter II presents six timber management alternatives that were developed to amend the 1983 FEIS and Forest Plan The presentation describes the development of the alternatives, displays the resource outputs and effects of each alternative, and compares the alternatives This includes a comparison with current Forest management

Chapter II has three main sections The first section summarizes the analysis process that was conducted prior to developing the alternatives (a much more detailed presentation of this analysis is described in Appendix B, Description of the Analysis Process) The second section details how each alternative was developed and includes a discussion of the purpose and management emphasis of each alternative. The third section compares the alternatives to each other The alternative comparison displays differences among the alternatives in response to issues, tradeoffs and opportunity costs, emphasized land uses, resource outputs and environmental effects, and economic costs and benefits

The principle goal in formulating alternatives is to "provide an adequate basis for identifying the alternative that comes nearest to maximizing net public benefits while responding effectively to the public issues" [36 CFR 219.12(f)]. Net public benefits is the overall long-term value to the nation of all Forest outputs and positive effects (benefits) minus all associated Forest inputs and negative effects (costs) whether these can be quantitatively valued or not

The Secretary's Decision directed the Forest to provide more complete information about issues of vegetation management on the Forest and economic considerations The Decision directed the Forest to develop new alternatives to explore these issues.

The current Forest Plan was approved in September 1983 The six alternatives developed in this FSEIS use the current Forest Plan as the framework from which the alternatives were designed The alternatives analyzed in this FSEIS were limited in scope to the following issues

1 The September 29, 1983 Record of Decision in the FEIS for the Forest Plan concerning timber demand;

2 The Secretary of Agriculture's Decision of July 31, 1985;

3 The inclusion of aspen vegetation in the suited timber land base; and

4. Below-cost timber sales.

DESCRIPTION OF THE ANALYSIS PROCESS

The 1983 Plan was developed using the 1979 version of [36 CFR 219 NFMA] implementing regulations. This FSEIS has been developed using the 1982 revision of implementing regulations 36 CFR 219. The steps used in the planning process are:

1 Identification of purpose and need;
2 Preparation of planning criteria,
3. Inventory collection of data and information;
4. Analysis of the management situation;
5 Formulation of the alternatives,
6. Estimation of the effects of the alternatives;
7. Evaluation of the alternatives, and
8 Recommendation of a preferred alternative.

The planning regulations [36 CFR 219.12(e) and (f)] and other directions guided the formulation of the alternatives for the FSEIS (See pages II-1 through II-4 of the original FEIS).

Appendix B of this FSEIS describes the entire analysis process in detail. Readers should refer to this appendix for technical information not included in the general description presented in this chapter

DEVELOPMENT OF THE FOREST PLANNING MODEL

INFORMATION AND DATA BASE

The new issues developed since the publication of the original FEIS required assembling information into a new data base using the Region 2 Resource Information System (R2-RIS) Specific resource information was entered into the data base to uniquely describe 50,000 distinct land areas ("sites")

ANALYSIS AREAS

The RIS data base was then used to identify analysis areas in the Forest that could capture significant biological and economic differences between alternative management strategies For these analysis areas, production and cost coefficients were developed that allowed the planning model to determine the tradeoffs between alternatives These analysis areas identify the major differences in costs and benefits of timber and water production between alternatives.

PRESCRIPTIONS

In the FORPLAN model, analysis areas are allocated to a management prescription. Management prescriptions in FORPLAN consist of a combination of management intensity (specific management practices) and a timing choice (first through the fifteenth decade)

The management emphases (Region 2's Uniform Management Prescriptions or UFMP's) are listed in Table II-5.

Management intensities are the individual activities or sequence of activities used in the treatment of vegetation to achieve the management emphasis objectives Table II-1 lists the management activities modeled in FORPLAN by three general categories no treatment, Even-Age Management, and Uneven-Age Management.

TABLE II-1

Management Practices Modeled in FORPLAN

Non-vegetative	Commercial
No treatment	*Even-Age Management* Clearcutting 3-Step shelterwood *Uneven-Age Management* Group selection

FORPLAN

The analytical tool used in the analysis is Version II of FORPLAN. Version II was selected due to its ease of data entry and its greater capability and versatility over that of the Version I model that was used for the original Forest Plan FORPLAN was used to analyze numerous management area allocations and timber harvesting schedules and to determine the potential for achieving the objectives of each alternative

FORPLAN is a "linear program" model designed to simulate the actions of the different resources, management, and environmental conditions on the Forest. It is also designed to find the "optimum" solution to a problem posed by the potentials and limitations of the land and resources, the effect of costs, budgets, and resource prices, and the desired objectives of resource outputs and environmental conditions.

The FORPLAN model is structured to seek the greatest economic efficiency (the most return for an investment) This is represented as a "maximize PNV" objective function ("PNV" or "present net value" is the current net value of the estimated flow of present and future monetary costs and benefits.) FORPLAN is able to estimate Forest-wide effects and monetary costs and benefits under the conditions specified to achieve the objectives of a particular alternative

The Interdisciplinary Team (ID) team was directly involved with the design, operation, and interpretation of the FORPLAN model. Using the identified analysis areas, appropriate management practices, and associated mathematical expressions, the ID team constructed the Forest model.

In the FORPLAN Model the outputs modeled were chosen because of their relationship to the public issues, management concerns and resource use and development opportunities (ICO's). Other outputs and effects were estimated outside of the FORPLAN model or by interpreting the results of the FORPLAN solution

USE OF FORPLAN IN ALTERNATIVE ANALYSIS

For each of the formulated alternatives, the resource management intent was defined in terms of resource constraints to be used in FORPLAN. A discussion of the constraints common to all the alternatives as well as the constraints unique to each alternative can be found in Appendix B, Chapter VII.

Each alternative was designed to be environmentally sound. Then, each alternative was analyzed using the FORPLAN model. The model was allowed to optimize the choice of efficient timber prescriptions subject to the resource management constraints of each alternative. These resource management constraints defined each alternative and also provided for the spatial and temporal feasibility of each alternative.

Lands identified as suitable were manually mapped considering Management Requirements and Standards and Guidelines as a last step in verifiying possible allocation and scheduling from FORPLAN. The actual on the ground arrangement of resources is impossible to completely represent in the model. This ground truthing was essential to acertaining that analysis results from the model could be implemented. This had an effect on the actual amount of acreage that is available under any alternative.

Between the draft and final SEIS, the Forest evaluated all tentatively suited lands on a site-specific basis using 1:24,000 scale topographic maps together with field verification and on-the-ground knowledge of Ranger District personnel. The criteria used to conduct the evaluation were based on 36 CFR 219.14(c). The criteria were applied as follows:

1. 36 CFR 219.14(c)(1) - "Based upon a consideration of multiple-use objectives for the alternative, the land is proposed for resource uses that preclude timber production, such as wilderness;".(FSH 2409.13, Chapter 32.2 further defines this category by saying "...Examples might be...managing a trail corridor for preservation of existing scenic qualities."). The lands identified in this category were made up primarily of ski areas and visually sensitive areas as identified by the public during the draft comment period.

2. 36 CFR 219.14(c)(2) - "Other management objectives for the alternative limit timber production activities to the point where management requirements set forth in § 219.27 cannot be met;". The lands identified in this category were those with unstable and slumpy soils where a high risk of irreversible damage could occur. They were lands that should not have passed the "tentatively suited" screen defined in FSH 2409.13, Chapter 21.41.

3. 36 CFR 219.14(c)(3) - "The lands are not cost efficient, over the planning horizon, in meeting forest objectives, which include timber production." While none of the tentatively suited lands were cost efficient (considering current costs and timber stumpage values), the least efficent tentatively suited lands were identified in this step. The Forest identified five categories of lands where the timber harvesting costs were greater than those considered "suited". They were: 1) lands where excessive surface rock existed (labeled "1" on the maps); 2) stands of timber physically isolated and removed from other timbered areas (labeled "2" on the maps); 3) stands of timber where productivity was far below average for the Forest (also labeled "2" on the maps); 4) lands over 40% slope (labeled "3" on the maps); and 5) lands with excessive road access costs due to either distance or sideslope where the roads would have to be built.

The analysis areas associated with each of these areas were identified and unique costs were developed for each of the five categories. The FORPLAN model was then modified to reflect this more accurate information reflecting actual on-the-ground conditions. The process is described in greater detail in Appendix B of the final SEIS beginning on page B-6.

MANAGEMENT REQUIREMENTS

All alternatives had to comply with the management requirements of applicable laws and regulations. The regulations pursuant to NFMA (36 CFR 219.27) include most of the direction applicable to the planning process for the following: resource protection, vegetative manipulation, silvicultural practices, even-aged management, riparian areas, soil and water, and diversity. To assure consistency in applying the laws and regulations to planning, Forest Service national and regional direction (October 14, 1981, and February 9, 1983, respectively) established requirements to be met in all alternatives. These requirements are known as management requirements or MRs.

The Forest ID Team defined the specific management requirements to apply to the Forest. The management requirements the ID Team used for each alternative were:

Nondeclining Yield & Sustained-Yield Link - (36 CFR 219.16) The Forest is now selling timber based on a policy of nondeclining even-flow. The constraint in the FORPLAN model is designed to ensure that sale levels in each decade are equal to or greater than sale levels in the previous decade. The sale level in the last decade of the planning horizon must be less than or equal to the long run sustained-yield calculated for the alternative.

Ending Inventory Constraint - (36 CFR 219.16) This constraint attempts to ensure that the total inventory volume remaining at the end of the planning horizon (150 years) is sufficient to maintain the timber sale pattern established for the given alternative.

Rotations at Culmination of Mean Annual Increment (CMAI) - (36 CFR 219.16) This constraint is intended to control the minimum age at which a timber stand can be harvested. The minimum age is determined by calculating the age at which the stand achieves 95 percent CMAI of timber volume growth.

Size of created openings and dispersion - (36 CFR 219 27 (b) & (d)) These constraints ensure that individual cuts created by the application of even-aged silviculture conform to the Regional Guide direction on dispersion of openings and maximum size limits for areas to be cut in one harvest operation.

Diversity - (36 CFR 219 27 (a)) An old growth constraint was applied to maintain diversity. Forest Direction (See Amended Forest Plan Chapter III page III-9a) is to maintain structural diversity with at least five percent of the forested area in old growth condition

Soil and Water - (36 CFR 219.27 (a)) The costs associated with soil and water protection were included in all prescriptions. The timber harvest dispersion constraints are also designed to prevent excessive soil erosion. Additionally, forest-wide soil and water standards and guidelines (See Amended Forest Plan, Chapter III pages III-51-52, 73-75) establish a direction which ensures that the Forest will meet these management requirements These are the key standards and guidelines for riparian areas·

- Maintain or improve all riparian ecosystems in at least an upper mid-seral successional stage based upon the R2 Riparian Ecosystem Rating System

- Provide mitigation measures to prevent increased soil erosion from exceeding "threshold limits" (as determined either by the "state of the art" HYSED model or by actual measuments) identified for each fouth-order watershed

- In cases of resource conflicts, preferential consideration will be given to riparian area resources over other resources within the management unit

ANALYSIS OF THE MANAGEMENT SITUATION (AMS)

A Supplemental Analysis of the Management Situation (AMS), provided a basis for the development and evaluation of the alternatives. The AMS (refer to Appendix B Section VI, for more discussions of the AMS) provided a picture of the Forests' ability to supply goods and services The AMS included

- The range and level of goods and services defined through benchmark analysis and identified in the "decision space" (See Appendix B page B-59)

- The demand and output estimates for various resources (See Appendix B pages B-60 through B-62).

- The possibilities for resolving issues, concerns, and opportunities (ICOs) (See Appendix B page B-82)

- The identification of the need to establish a change in direction (See Appendix B page B-83)

Role and Use of Benchmarks

The AMS included the creation of "benchmarks," and the inspection of their outputs, costs, and assumptions Benchmarks are similar to alternatives in that they are a combination of land capability, management practices, and schedules and are used to achieve certain objectives But, unlike alternatives, benchmarks are usually not capable of being implemented because they lack a consideration of such factors as likely budgets, specific geographic locations, environmental effects, compliance with management regulations, and legal requirements. Benchmarks do provide information about the maximum biological and economic production opportunities and they help in evaluating the compatibilities and conflicts between market and nonmarket objectives Benchmarks define the range within which integrated and practical alternatives can be developed

Some benchmarks are designed to maximize economic efficiency. Others indicate the maximum physical productivity of land for various resources. Most benchmark analyses include meeting such management requirements (MRs) of 36 CFR 219.27 as protecting the productivity of the land and protecting minimum air and water quality standards Benchmarks which do not meet all MRs are designed specifically to identify the opportunity costs and tradeoffs of one or more MRs.

Some benchmarks are required by the NFMA regulations [36 CFR 219.12 (e)] and FSM 192. These include

- minimum level of resource outputs which occur naturally.
- maximum resource levels, including supply analysis for resources as they relate to multiple-use benefits
- maximum Present Net Value (PNV) based on resource outputs with an established market price.
- maximum PNV based on resource outputs with an established market price and resources with an assigned value

Other benchmarks were developed to explore the potential of resolving identified issues, concerns and opportunities (ICOs).

The original benchmark analysis (See 1983 FEIS Appendix C) process involved eleven benchmarks. The Forest Plan Amendment process involved the development of additional benchmarks to meet the Forest Service manual direction. Some of the original benchmarks were not reanalyzed during the Amendment process. (A complete discussion of the benchmarks can be found in FSEIS Appendix B Section VI)

RESOURCE DEMAND POTENTIALS

The Forest Plan Amendment process includes new timber demand estimates Demand for the Forest's other resources was also reanalyzed to provide comparable estimates to the new timber demand estimates

Knowledge of demand is important for two reasons: when compared to the Forest's supply potential, demand estimates make it possible to determine whether demand will be less than or equal to supply Also, demand indicates how much a priced resource output will be valued for purposes of economic evaluation Resource outputs with no demand have no value The demand projections reflect historical use patterns and/or regional and national trends applied to the local situation

Specific demand level for aspen POL (Products Other Than Logs), conifer POL, aspen sawtimber, and conifer sawtimber have been determined and are now included in the total timber demand for wood fiber from the Forest (See Demand Scenario D-2 in FSEIS Appendix B Section VI)

Analysis indicates that we will have difficulty meeting the current demand for wood fiber without changing standards and guidelines designed to enhance or protect other resources The potential to increase water yield is less than the expected future demand The supply of recreation opportunities exceeds current demand levels.

FORMULATION OF ALTERNATIVES

The 1983 EIS considered nine alternatives. Alternative 1 was selected for Forest Plan implementation for the reasons explained in the Record of Decision The subsequent appeals and the ensuing direction for further analysis and documentation dealt only with the timber management portion of the Plan Development of alternatives which re-assessed other resource programs such as recreation, wilderness, or minerals were outside the scope of the Forest Plan Amendment.

Alternative Treatment Methods

The USDA decision remanded the Plan for further analysis to analyze alternative noncommercial vegetation treatment methods to achieve multiple use benefits These alternative treatment methods were to include prescribed fire, cut and leave, cut and burn, and chemical treatment. During the AMS, we analyzed alternative treatment methods in detail, but they were not found to be effective methods of producing the benefits originally claimed A summary of alternative treatment methods and their effectiveness follows:

Alternative Treatment Method	Comments on Effectiveness
Prescribed Fire	While prescribed fire can regenerate tree stands, experience has shown that successful burns are limited to the drier portions of the forest and to timber stands with adequate understory and/or ground fuels. The burning season in the GMUG is short and the weather during this season is unpredictable Also, the majority of the lands considered tentatively suited for timber production are at the higher elevations of the Forest and hence have greater precipitation and cooler temperatures then are necessary for a successful prescribed burn Some timber stands contain adequate understory to assure effective burning but others do not. Because of short and unpredictable burning seasons, wet sites, and variable fuel conditions, an annual program aimed at effectively regenerating up to 4,000 acres per year of mature trees (140 year treatment cycle of the Forest's conifer-invaded aspen, ponderosa pine, & lodgepole pine) would be extremely difficult, if not impossible, to achieve. Commercial wood products would not be used The possibilities for increased insect and disease infestations could also occur following a prescribed fire.
Mechanical Methods Including Cut and Leave, Cut and Burn, and Bulldoze	Mechanical methods may be economically efficient methods to produce water benefits, but they are visually disruptive, create wildlife migration barriers, and increase fuel loadings which, in turn, increase the risk of damage from fire, insects, and diseases. Mechanical methods do not use commercial wood products and would be very controversial methods to achieve forest management objectives.
Chemical Treatments	While chemical treatments may effectively kill mature stands of timber (especially aspen) and encourage new growth, tremendous increases in dead trees would occur which would increase the risk of fire. Chemical treatments would not use commercial wood products. The treatments would be controversial and of only limited practical use for large-scale projects All of the alternative treatment methods are financially inefficient They require an expenditure of federal funds, yet, they return no money to the government.

We also believe that original claims of the other resource benefits achieved by commercial timber sales were overstated; as a result the need to closely analyze alternative treatment methods has diminished. The Secretary was concerned about the claims of benefits produced by a commercial timber sale program and asked the Forest to consider alternative treatment methods that might be more effective. The analysis shows that the priced resource benefits resulting from commercial sales are limited to

- water augmentation for all species except ponderosa pine
- some minor forage increases on big game winter range (only six percent of the tentatively suited commercial timber lands fall on big game winter range)
- minor forage increases for domestic livestock.

The benefits which are attributed to the timber sale program are divided into two classes: benefits which can be quantified and benefits which cannot be quantified

Benefits Which Can Be Quantified

- the capability to meet the demand for commercial wood fiber
- financial and economic efficiency
- the impact on jobs and income in the surrounding communities and industry.

Benefits Which Cannot Be Quantified

- prevention of future expenditures of federal funds to combat insect and disease outbreaks in lodgepole and ponderosa pine
- maintenance of the aspen type in conifer-invaded stands
- improved habitat diversity in closed canopy forest types
- the ability to decrease fuel buildups and so reduce the risk of large wildfires in the future.

ALTERNATIVES

Amendment alternatives were limited in scope to timber management issues. Other Forest resources such as minerals, range, recreation, or wildlife will continue to be managed according to the 1983 Forest Plan The Forest did re-determine the demand for other Forest resource uses, but, the analysis has showed that the commercial timber sale program has limited abilities to meet other Forest resource demands. Other activities such as vegetation and non-vegetation treatments on lands not in the suited land base for timber harvest will produce these goods and services. Timber harvest levels and financial and economic efficiencies thus became the sensitive variables used to define a broad range of alternatives for the Amendment

The alternatives considered in detail include Alternatives 1A, 1C, 1D, and 1E from the DSEIS. Two new alternatives were added to better address public comments obtained between the Draft and Final SEIS. Alternative 1G was added to address all the public comments received after the DSEIS was released, and Alternative 1H was added to respond to comments by the state of Colorado as well as to provide a more reasonable range of alternatives. These two new alternatives do lie within the scope of alternatives analyzed in the draft SEIS.

Alternatives not Considered in Detail

Alternatives 1B and 1F, which were considered in detail in the Draft SEIS, were not displayed in the final SEIS as reasonable alternatives

Alternative 1B attempted to meet all existing timber demand as well as to provide additional wood fiber in order to encourage growth in the local timber industry The analysis of the effects of Alternative 1B demonstrated that the proposed harvest levels would exceed the standards and guidelines established for the Forest during the planning process. The resources most susceptible to the environmental impacts of a large timber program include roadless areas, and visual quality and stream channels in the Forest (see pages IV-29-30, 32-34). We also recognize that GMUG timber program was a deficit program, (i e costs exceed revenues) and little public benefit could result from encouraging growth in the industry with a below cost timber program (see last paragraph on page C-49 of the Secretary's letter) For these reasons, Alternative 1B was not displayed in the Final SEIS as a reasonable alternative

The primary goal of Alternative 1F was to provide a financially efficient timber program Using the current average prices (See FSEIS Appendix B, Chapter IV), no acres on the Forest were found to be financially efficient, and thus Alternative 1F was not analyzed or displayed as a viable alternative

Alternatives Considered in Detail

Alternative 1A

Description

Alternative 1A continues the current timber management direction as prescribed in the Forest Plan approved 9/83, which is to maintain or enhance the stability of industries needed to produce local and regional goods and services. Alternative 1A is considered to be the "no action" alternative required by NEPA and it also represents the "RPA" alternative required by NFMA (Forest Plans become the RPA alternative) Possible negative effects of timber harvesting and road construction to other resource values will be mitigated through implementation of standards and guidelines in the Forest Plan.

Alternative 1A includes 29% of the Forest's commercial timber land (tentatively suited timber land) as land where timber harvesting may take place during the next 150 years (suited timber land) Timber harvesting occurs on 2% of the Forest's suited timber land annually during the first ten years of the plan

Over time, two thirds of the Forest's commercial timber land remains in a natural state and approximately one third is managed for timber and has a relatively extensive road network Diversity will be high on suited timber land as timber harvesting occurs Old growth values will be high and will continue to increase on those commercial timber acres not suited for timber production

The mix of primitive, rural, and urban recreation opportunities on the Forest remain unchanged. Approximately 3% of semi-primitive non-motorized acres will be converted to semi-primitive motorized and roaded natural acres. Alternative 1A timber harvesting will enter 3,000 roadless (RARE II inventoried) area acres in the first decade, including 1,400 acres in the Roubideau & Tabegauche sensitive roadless areas. The conifer sawtimber program will enter highly scenic areas and high road cost acres to harvest the 31.5 million board foot sawtimber allowable sale quantity

The Alternative 1A timber harvest program will clear cut slightly less than 20% of annual harvest acres, the remaining acres will be shelterwood harvested All spruce-fir and ponderosa pine will be shelterwood harvested, and aspen and lodgepole pine will be clear cut Spruce-fir harvesting accounts for approximately 77% of all harvest acres followed by lodgepole pine (14%), ponderosa pine (6%), and aspen (4%). All suited timber lands will receive even-aged timber management

Alternative 1A

RESULTS

Timber Data

- Total Acres Suited for Timber Production . . . . . 362,498 Acres
- Aspen Acres Suited for Timber Production . . . . . 25,972 Acres
- Allowable Sale Quantity (1st Decade) . . . . . 7,000 MCF/Yr
- Long Term Sustained Yield Level . . . . . 50 MMBF
- % of Forest Suited for Timber Production 12%
- Acres of Aspen Harvest on Suited Timber Lands . . . 310 Acre/Yr
- Area Treated to Reduce Insects & Disease . . . . 1,672 Acre/Yr

Non-timber Data

- Incremental Water Yield (1st Decade) . . . . . 13 1 MAcFt/Yr
- Local Road Construction (1st Decade) . . . . . 24 Miles/Yr
- Local Road Reconstruction (1st Decade) . . . . . 25 Miles/Yr
- Sensitive roadless Areas Developed in the First Decade . . . . . 2 Area

Social & Economic Data

- Total Timber PNV (includes water benefits) . . . . . -3.291 MM$
- Timber PNV (timber benefits only) . . . . . -20 559 MM$
- Increased Water Yield PNV (present value benefit) 17 268 MM$
- Net Timber Receipts Decade One . . . . . -1.140 MM$/Yr
- Net Timber Receipts First 50 Years . . . . . -.695 MM$/Yr
- Timber/Road Budget . . . . . 1 830 MM$/Yr
- Timber Break Even Price $52.2/MBF
- Employment . . . . . *
- Total Income . . . . . *
- Payment (from 25% of gross receipts) to Counties from Timber Receipts . . . . . .173 MM$/Yr
- Sawtimber Demand Supplied (Percent) 102%
- Conifer POL Demand Supplied (%) 0%
- Aspen POL Demand Supplied (Percent) 11%

Alternative 1C

Description

Alternative 1C examines a timber harvest program which harvests only economically efficient timber An economically efficient timber sale is one where the timber revenues and the benefit from water production exceed the costs of the timber sales

The purpose for timber harvesting under Alternative 1C is to provide wood fiber to support local industry only to the extent the program is economically efficient. Secondary benefits considered are limited to water production Possible negative effects of timber harvesting and road construction to other resource values will be mitigated through implementation of standards and guidelines in the Forest Plan.

Alternative 1C includes 23% of the Forest's commercial timber land (tentatively suited timber land) as land where timber harvesting may take place during the next 150 years (suited timber land) Timber harvesting occurs on 2% of the Forest's suited timber land annually during the first ten years of the plan.

Over time, three fourths of the Forest's commercial timber land remains in a natural state and approximately one fourth is managed for timber and has a relatively extensive road network Diversity will be high on suited timber land as timber harvesting occurs. Old growth values will be high and will continue to increase on those commercial timber acres not suited for timber production.

The mix of primitive, rural, and urban recreation opportunities on the Forest remain unchanged Approximately 2% of semi-primitive non-motorized acres will be converted to semi-primitive motorized and roaded natural acres Alternative 1C timber harvesting will enter 2,100 roadless area acres in the first decade, without entering the Roubideau & Tabegauche sensitive roadless areas. The timber program not be required to enter highly scenic areas and high road cost acres to harvest the 19.6 million board foot allowable sale quantity.

The Alternative 1C timber harvest program will shelterwood harvested all annual harvest acres Only spruce-fir will be harvested Spruce-fir harvesting accounts for 100% of all harvest acres, and lodgepole pine, ponderosa pine, and aspen harvesting will be eliminated. All suited timber lands will receive even-aged timber management.

Alternative 1C **RESULTS**

Timber Data

- Total Acres Suited for Timber Production . . . . . 287,882 Acres
- Aspen Acres Suited for Timber Production . . . . . 281 Acres
- Allowable Sale Quantity (1st decade) . . . . . 4.359 MCF/Yr
- Long Term Sustained Yield Level . . . . . 42 MMBF
- % of Forest Suited for Timber Production 10%
- Acres of Aspen Harvest on Suited Timber Lands . . . . . 0 Acre/Yr
- Area Treated to Reduce Insects & Disease . . . . . 0 Acre/Yr

Non-timber Data

- Incremental Water Yield (1st Decade) . . . . . 7.5 AcFt/Yr
- Local Road Construction (1st Decade) . . . . . 11 Mile/Yr
- Local Road Reconstruction (1st Decade) . . . . . 15 Mile/Yr
- Sensitive roadless Areas Developed in the First Decade . . . . . 0 Area

Social & Economic Data

- Total Timber PNV (Includes Water Benefits) . . . . . -1 216 MM$
- Timber PNV (Timber Benefits Only) . . . . . -11.324 MM$
- Increased Water Yield PNV (Present Value Benefit) . . . . 12 540 MM$
- Net Timber Receipts Decade One . . . . . - 585 MM$/Yr
- Net Timber Receipts First 50 Years . . . . . -.361 MM$/Yr
- Timber/Road Budget . . . . . 1.062 MM$/Yr
- Timber Break Even Price $54.2/MBF
- Employment . . . . . *
- Total Income . . . . . *
- Payment (from 25% of gross receipts) to Counties from Timber Receipts . . . . . .119 MM$/Yr
- Sawtimber Demand Supplied (%) 63%
- Conifer POL Demand Supplied (%) 0%
- Aspen POL Demand Supplied (%) 0%

Alternative 1D

Description

This alternative emphasizes amenity values by promoting non-commodity goods and services The intent is to stress minimum market opportunities and minimize man's influence in managing the forest. Timber harvesting activities are limited to existing roaded areas, spruce-fir harvesting is accomplished using low impact harvest methods

The purpose for timber harvesting under Alternative 1D is to provide minimal support to the local sawtimber industry based on average harvest levels between 1980 to 1986 before the recent increase in sawtimber harvesting began, and to harvest aspen only to the extent necessary to keep aspen stands from falling apart or converting to conifer in the roaded area. Possible negative effects of timber harvesting and road construction to other resource values will be mitigated through implementation of standards and guidelines in the Forest Plan.

Alternative 1D includes 16% of the Forest's commercial timber land (tentatively suited timber land) as land where timber harvesting may take place during the next 150 years (suited timber land). Timber harvesting occurs on 2% of the Forest's suited timber land annually during the first ten years of the plan.

Over time, five sixths of the Forest's commercial timber land remains in a natural state and approximately one sixth is managed for timber and has a relatively extensive road network. Diversity will not change significantly on suited timber land as timber harvesting occurs due to selection harvesting in spruce-fir and minimal aspen harvesting Old growth values will be high and will continue to increase on those commercial timber acres not suited for timber production.

The mix of primitive, rural, and urban recreation opportunities on the Forest remain unchanged. Approximately 2% of semi-primitive non-motorized acres will be converted to semi-primitive motorized and roaded natural acres. Alternative 1D timber harvesting will enter 1,300 roadless area acres in the first decade, without entering the Roubideau & Tabegauche sensitive roadless areas. The timber program will not enter highly scenic areas and high road cost acres to harvest the 18.9 million board foot timber allowable sale quantity

The Alternative 1D timber harvest program will clear cut slightly less than 16% of annual harvest acres, the remaining acres will be selection harvested. All spruce-fir will be selection harvested, and aspen will be clear cut Spruce-fir harvesting accounts for approximately 84% of all harvest acres followed by aspen at 16% Ponderosa pine and lodgepole pine will not be harvested. Approximately 64% all suited acres will receive uneven-aged timber management and the remaining 36% will receive uneven-aged timber management.

Alternative 1D

RESULTS

Timber Data

- Total Acres Suited for Timber Production . 200,203 Acres
- Aspen Acres Suited for Timber Production . . . . . 36,733 Acres
- Allowable Sale Quantity (1st Decade) . . . . . 4,282 MCF/Yr
- Long Term Sustained Yield Level . . . . . 35 MMBF
- % of Forest Suited for Timber Production 7%
- Acres of Aspen Harvest on Suited Timber Lands . . . . 489 Acre/Yr
- Area Treated to Reduce Insects & Disease . . . . . 0 Acre/Yr

Non-timber Data

- Incremental Water Yield (1st Decade) 1 0 MAcFt/Yr
- Local Road Construction (1st Decade) . 9 Mile/Yr
- Local Road Reconstruction (1st Decade) . . . 10 Mile/Yr
- Sensitive Roadless Areas Developed in the First Decade . . . . . 0 Area

Social & Economic Data

- Total Timber PNV (Includes Water Benefits) . . . . . -12 707 MM$
- Timber PNV (Timber Benefits Only) . . . . . -13 690 MM$
- Increased Water Yield PNV (Present Value Benefit) . . . . . .983 MM$
- Net Timber Receipts Decade One . . . . . -.597 MM$/Yr
- Net Timber Receipts First 50 Years . . . . . - 547 MM$/Yr
- Timber/Road Budget . . . . . 1.007 MM$/Yr
- Timber Break Even Price $53 0/MBF
- Employment . . . . . *
- Total Income . . . . . *
- Payment (from 25% of gross receipts) to Counties from Timber Receipts . . . . . 102 MM$/Yr
- Sawtimber Demand Supplied (%) 53%
- Conifer POL Demand Supplied (%) 0%
- Aspen POL Demand Supplied (%) 8%

Alternative 1E

Description

Alternative 1E was the Preferred Alternative in the Proposed Amendment published in 1989 and was developed through a series of meetings between environmental groups, timber industry, local & state government, and the Forest Service collectively known as the Keystone Process While it does not have the consent of all the parties, it is the result of the process

The purpose for timber harvesting under Alternative 1E is to provide wood fiber limited only by the Forest's ability to meet standards & guidelines and maintain the current level of multiple uses on the Forest. Secondary benefits include timber related jobs; water yield; increased resistance to insects, disease and fire; maintenance of aspen stands now falling apart or being replaced by conifer; and creation of ecological diversity through a mosaic of stands of all ages Possible negative effects of timber harvesting and road construction to other resource values will be mitigated through implementation of standards and guidelines in the Forest Plan.

Alternative 1E includes 70% of the Forest's commercial timber land (tentatively suited timber land) as land where timber harvesting may take place during the next 150 years (suited timber land) Timber harvesting occurs on 1% of the Forest's suited timber land annually during the first ten years of the plan.

Over time, less than one third of the Forest's commercial timber land remains in a natural state and more than two thirds is managed for timber and has a relatively extensive road network. Diversity will be high on suited timber land as timber harvesting occurs. Old growth values will be high and will continue to increase on those commercial timber acres not suited for timber production

The mix of primitive, rural, and urban recreation opportunities on the Forest remain unchanged. Approximately 5% of semi-primitive non-motorized acres will be converted to semi-primitive motorized and roaded natural acres. Alternative 1E timber harvesting will enter 10,242 roadless area acres in the first decade, including 2,400 acres in the Roubideau & Tabegauche sensitive roadless areas The timber program will enter highly scenic areas and high cost acres to harvest the 61.5 million board foot timber allowable sale quantity.

The Alternative 1E timber harvest program will clear cut slightly less than 31% of annual harvest acres, the remaining acres will be shelterwood harvested All spruce-fir and ponderosa pine will be shelterwood harvested, and aspen and lodgepole pine will be clear cut Spruce-fir harvesting accounts for approximately 64% of all harvest acres followed by aspen (24%), lodgepole pine (6%), and ponderosa pine (6%) All suited timber lands will receive even-aged timber management.

Alternative 1E **RESULTS**

Timber Data

- Total Acres Suited for Timber Production . . . . . 881,123 Acres
- Aspen Acres Suited for Timber Production . . . . 284,534 Acres
- Allowable Sale Quantity (1st decade) . . . . . 14,501 MCF/Yr
- Long Term Sustained Yield Level . . . . . 106 MMBF
- % of Forest Suited for Timber Production 30%
- Acres of Aspen Harvest on Suited Timber Lands . . . 2,797 Acre/Yr
- Area Treated to Reduce Insects & Disease . . . . . 1,400 Acre/Yr

Non-timber Data

- Incremental Water Yield (1st Decade) . . . . . 17 4 MAcFt/Yr
- Local Road Construction (1st Decade) . . . . . 41 Mile/Yr
- Local Road Reconstruction (1st Decade) . . . . . 39 Mile/Yr
- Sensitive Roadless Areas Developed in the First Decade . . . . . 2 Area

Social & Economic Data

- Total Timber PNV (Includes Water Benefits) . . . . -15.077 MM$
- Timber PNV (Timber Benefits Only) . . . . . -41.600 MM$
- Increased Water Yield PNV (Present Value Benefit) . . . . 26.523 MM$
- Net Timber Receipts Decade One . . . . . -1 822 MM$/Yr
- Net Timber Receipts First 50 Years . . . . . -1.572 MM$/Yr
- Timber/Road Budget . . . . . 2.856 MM$/Yr
- Timber Break Even Price $46.4/MBF
- Employment . . . . . *
- Total Income . . . . . *
- Payment (from 25% of gross receipts) to Counties from Timber Receipts . . . . . .259 MM$/Yr
- Sawtimber Demand Supplied (%) 100%
- Conifer POL Demand Supplied (%) 55%
- Aspen POL Demand Supplied (%) 91%

Alternative 1G
(Preferred Alternative)

Description

Alternative 1G emphasizes a timber management program based on overwhelming public comment to reduce below cost timber sales, and not harvest in highly scenic areas, while providing for a high level of wood fiber production in the remaining lands available to help maintain local timber dependent jobs

The purpose for timber harvesting under Alternative 1G is to provide wood fiber to local industry and other multiple uses at high levels as directed by the Multiple-Use Sustained-Yield Act and to provide for timber dependent jobs to the extent practical on the Forest's most appropriate commercial timber lands Secondary benefits include water yield, increased resistance to insects, disease, and fire, maintenance of aspen stands now falling apart or being invaded by conifer; and creation of ecological diversity through a mosaic of stands of all ages. Possible negative effects of timber harvesting and road construction to other resource values will be mitigated through implementation of standards and guidelines in the Forest Plan

Alternative 1G includes 44% of the Forest's commercial timber land (tentatively suited timber land) as land where timber harvesting may take place during the next 150 years (suited timber land). Timber harvesting occurs on 1% of the Forest's suited timber land annually during the first ten years of the plan.

Over time, slightly more than half of the Forest's commercial timber land remains in a natural state and slightly less than half is managed for timber and has a relatively extensive road network. Diversity will be high on suited timber land as timber harvesting occurs. Old growth values will be high and will continue to increase on those commercial timber acres not suited for timber production.

The mix of primitive, rural, and urban recreation opportunities on the Forest remain unchanged. Approximately 3% of semi-primitive non-motorized acres will be converted to semi-primitive motorized and roaded natural acres. Alternative 1G timber harvesting will enter 4,500 roadless area acres in the first decade, without entering the Roubideau & Tabegauche sensitive roadless areas. The timber program will not enter highly scenic areas and high road cost acres to harvest the 38.8 million board foot timber allowable sale quantity.

The Alternative 1G timber harvest program will clear cut slightly less than 29% of annual harvest acres, the remaining acres will be shelterwood harvested All spruce-fir and ponderosa pine will be shelterwood harvested, and aspen and lodgepole pine will be clear cut. Spruce-fir harvesting accounts for approximately 62% of all harvest acres followed by aspen (19%), lodgepole pine (10%), and ponderosa pine (9%). All suited timber lands will receive even-aged timber management.

Alternative 1G
(Preferred Alternative)

RESULTS

Timber Data

- Total Acres Suited for Timber Production . . . . 550,131 Acres
- Aspen Acres Suited for Timber Production . . . . . 169,318 Acres
- Allowable Sale Quantity (1st decade) . . . . . 9,127 MCF/Yr
- Long Term Sustained Yield Level . . . . . 63 MMBF
- % of Forest Suited for Timber Production 19%
- Acres of Aspen Harvest on Suited Timber Lands . . 1,376 Acre/Yr
- Area Treated to Reduce Insects & Disease . . . . 1,400 Acre/Yr

Non-timber Data

- Incremental Water Yield (1st Decade) . . . . . 11.1 MAcFt/Yr
- Local Road Construction (1st Decade) . . . . . 24 Mile/Yr
- Local Road Reconstruction (1st Decade) . . . . . 23 Mile/Yr
- Sensitive roadless Areas Developed in the First Decade . . . . . 0 Area

Social & Economic Data

- Total Timber PNV (includes water benefits) . . . . . -6.578 MM$
- Timber PNV (timber benefits only) . . . . . -22.869 MM$
- Increased Water Yield PNV (present value benefit) . . . 16 291 MM$
- Net Timber Receipts Decade One . . . . . -1.040 MM$/Yr
- Net Timber Receipts First 50 Years . . . . . - 835 MM$/Yr
- Timber/Road Budget . . . . . 1 711 MM$/Yr
- Timber Break Even Price $44 1/MBF
- Employment . . . . . *
- Total Income . . . . . *
- Payment (from 25% of gross receipts) to Counties from Timber Receipts . . . . . 168 MM$/Yr
- Sawtimber Demand Supplied (%) 68%
- Conifer POL Demand Supplied (%) 55%
- Aspen POL Demand Supplied (%) 50%

Alternative 1H

Description

Alternative 1H emphasizes a timber management program identical to Alternative 1G except for an additional 630 acres of aspen harvesting annually. The additional aspen volume provides increased assurance local industry will remain in the area at the expense of harvesting in the more scenic and expensive areas of the Forest

The purpose for timber harvesting under Alternative 1H is to provide wood fiber to local industry and other multiple uses at high levels as directed by the Multiple-Use Sustained-Yield Act and to provide for timber dependent jobs to the extent practical on the Forest's most appropriate commercial timber lands. A special emphasis is given to maintaining waferwood jobs at the cost of entering the high cost aspen stands on the Forest. Secondary benefits include water yield, increased resistance to insects, disease, and fire, maintenance of aspen stands now falling apart or being invaded by conifer, and creation of ecological diversity through a mosaic of stands of all ages. Possible negative effects of timber harvesting and road construction to other resource values will be mitigated through implementation of standards and guidelines in the Forest Plan.

Alternative 1H includes 50% of the Forest's commercial timber land (tentatively suited timber land) as land where timber harvesting may take place during the next 150 years (suited timber land) Timber harvesting occurs on 1% of the Forest's suited timber land annually during the first ten years of the plan.

Over time, one half of the Forest's commercial timber land remains in a natural state and one half is managed for timber and has a relatively extensive road network Diversity will be high on suited timber land as timber harvesting occurs. Old growth values will be high and will continue to increase on those commercial timber acres not suited for timber production.

The mix of primitive, rural, and urban recreation opportunities on the Forest remain unchanged. Approximately 4% of semi-primitive non-motorized acres will be converted to semi-primitive motorized and roaded natural acres. Alternative 1H timber harvesting will enter 4,800 roadless area acres in the first decade without entering the Roubideau & Tabegauche sensitive roadless areas. The conifer timber program will not enter highly scenic areas and high road cost acres, but the aspen program will enter high road cost acres to harvest the 45.8 million board foot timber allowable sale quantity.

The Alternative 1H timber harvest program will clear cut slightly less than 34% of annual harvest acres, the remaining acres will be shelterwood harvested. All spruce-fir and ponderosa pine will be shelterwood harvested, and aspen and lodgepole pine will be clear cut. Spruce-fir harvesting accounts for approximately 57% of all harvest acres followed by aspen (25%), lodgepole pine (9%), and ponderosa pine (8%) All suited timber lands will receive even-aged timber management.

Alternative 1H **RESULTS**

Timber Data

- Total Acres Suited for Timber Production . . . . . 621,966 Acres
- Aspen Acres Suited for Timber Production . . . . 241,153 Acres
- Allowable Sale Quantity (1st decade) . . . . . 10,877 MCF/Yr
- Long Term Sustained Yield Level . . . . . 70 MMBF
- % of Forest Suited for Timber Production 21%
- Acres of Aspen Harvest on Suited Timber Lands . . . 2,006 Acre/Yr
- Area Treated to Reduce Insects & Disease . . . . . 1,400 Acre/Yr

Non-timber Data

- Incremental Water Yield (1st Decade) . . . . . 12.4 MAcFt/Yr
- Local Road Construction (1st Decade) . . . . . .29 Mile/Yr
- Local Road Reconstruction (1st Decade) . . . .26 Mile/Yr
- Sensitive Roadless Areas Developed in the First Decade . . . . . 1 Area

Social & Economic Data

- Total Timber PNV (Includes Water Benefits) . . . -10 126 MM$
- Timber PNV (Timber Benefits Only) . . . . . -27.516 MM$
- Increased Water Yield PNV (Present Value Benefit) . . . . 12.424 MM$
- Net Timber Receipts Decade One . . . . . -1.253 MM$/Yr
- Net Timber Receipts First 50 Years . . . . . -1 029 MM$/Yr
- Timber/Road Budget . . . . . 1.002 MM$/Yr
- Timber Break Even Price $43 7/MBF
- Employment . . . . . *
- Total Income . . . . . *
- Payment (from 25% of gross receipts) to Counties from Timber Receipts . . . . . .187 MM$/Yr
- Sawtimber Demand Supplied (%) 68%
- Conifer POL Demand Supplied (%) 55%
- Aspen POL Demand Supplied (%) 72%

MITIGATING MEASURES

In all of the alternatives, the timber management activities may have effects on visual quality, water quality, soil productivity, riparian areas, and wildlife and fish habitat. Forest Standards and Guidelines have been developed to mitigate potential adverse environmental impacts on the Forest. Some management requirements have been included in the Standards and Guidelines. Additional details for mitigation can be found in Chapter III of the Forest Plan Amendment.

COMPARISON OF ALTERNATIVES

OVERVIEW

The estimation of effects and evaluation of alternatives section presents information on the alternatives in a variety of ways to make comparisons of the alternatives easier The aspects of the alternatives and their analyses which are presented for comparison include.

- Comparison tables that display resource outputs, environmental effects, costs, and activities for the alternatives .
- A comparison of alternative resource programs which encompasses a discussion of key output results and the changes and differences of these key output results among the alternatives
- Economic comparisons which include key economic concepts and analysis results.
- A comparison of the major tradeoffs among the alternatives.

Achieving the highest degree of net public benefits (NPB) is an important goal of the Forest Planning process The purpose of the comparisons is to help identify and select the alternative which achieves the highest net public benefit while also responding effectively to public issues. Net public benefits are defined as "the overall value to the Nation of all outputs and positive effects (benefits) less all the associated inputs and negative effects (costs), whether these can be quantitatively valued or not." Eventually, "net public benefits" is the sum of the present net value of priced outputs (See FSEIS II-32) plus the net value of all nonpriced outputs. Net public benefits are highest in the alternative which has the greatest excess of benefits over costs. However, net public benefits also include qualitatively valued nonpriced outputs or effects which cannot be expressed as a numeric quantity. Therefore, identifying the alternative which achieves the highest net public benefit becomes, to some degree, a subjective decision. Differences of opinion exist about whether the particular effects of the alternatives are positive or negative Therefore, the major effects of each alternative are defined separately for review, judgement, and the eventual selection of an alternative.

CHANGES IN MANAGEMENT AREA ALLOCATIONS

The Forest Plan identifies management areas on a map Within each management area, a broad range of multiple-use activities can occur. Unless restricted by statute or policy, commercial timber sales can be scheduled on lands suited for timber production in most management areas The purpose of the management area designations is to define the management emphasis of each part of the forest and to prescribe specific direction and standards for management activities on these areas. Management differs among the areas primarily because of differences in the standards and guidelines described in Chapter III of the Plan.

In the EIS each alternative was made up of a different mixes of management area prescriptions assigned to the land This is not the case in the Forest Plan Amendment process; while the Forest proposes to change some of the management area boundaries and associated standards and guidelines, management area changes apply to all the alternatives equally During the Forest Plan Amendment process, the ID Team discovered that the acreages published in the Forest Plan on pages III-88 through III-90 were in error for some of the management areas The correct acreages for the management areas as well as the suited acres for the preferred alternative (1G) are displayed in Table II-5:

The management area changes are:

- Some dispersed recreation areas (2A) were mapped as roaded natural areas (2B) because of four wheel drive opportunities. The 2B designation should included only been a corridor along the primitive roads since off-road motorized use is prohibited in the areas themselves. Therefore, 2B acres became semi-primitive motorized (2A)

- The woody draw prescription (4C) was intended for use on National Grasslands and was inappropriately assigned during the original Plan development The acres were generally reassigned to the management area prescription of the area adjacent to them, most 4C acres became either wildlife indicator species (4B), range management (6B), or aspen management (4D) emphasis areas.

- In the wood fiber production emphasis areas, management prescriptions 7A (clearcutting) and 7E (shelterwood), were combined into the revised 7A This does not specify which logging method will be used to but allows, instead, for on-the-ground determination of logging method

- No lands over 40% slope are considered suited for timber production; therefore the management area emphasis in 7C (timber production on steep slopes) was not appropriate. The 7C areas were generally reassigned to the management area prescription of the area adjacent to them

- The 13,256 acres of management emphasis identified for water production through vegetative management (9B) were considered inappropriate for two reasons: 1) the Forest does not intend to manage lands through the commercial timber sale program for the primary purpose of augmenting water flows. (but will claim these benefits when and where they occur) and 2) most of the 9B areas were aspen forests where rapid sprouting limits water production to about half of the capabilities in spruce/fir and lodgepole pine forests. The 9B areas were reassigned to 4D (aspen), 2A (semi-primitive motorized), and 7A (wood fiber production). The effects of the changes are, in practical application, minor.

Response to Issues

Chapter I, identifies issues addressed in the analysis documented in this SEIS. The response of various alternatives to these issues is discussed throughout Chapters II and III. Table II-2 is a summary of alternatives response to issues.

TABLE II-2 RESPONSE OF ALTERNATIVES TO ISSUES

Alternative (across) Issue (down)	1A	1C	1D	1E	1G	1H
Global Warming - Will the timber harvest program affect the global climate?	No Change	No Change	No Change	No Change	No Change	No Change
Level of Aspen Cutting - How much aspen will be harvested annually and how much will be harvested over the next 150 years?						
Annual Acres percent of total	06%	0%	09%	53%	26%	38
150 Year Acres percent of total	4 9%	05%	6 92%	53 63%	31.92	45 46
Timber Harvesting - How much timber will be harvested annually and how much will be harvested over the next 150 years?						
Annual Acres percent of total	47%	33%	20%	63%	40%	44
150 Year Acres percent of total	19 87%	15 78%	10 97%	48 29%	30 15	34 09
Clearcutting - How much of the Forest's timber will be clearcut annually?						
Annual Acres percent of total	08%	0%	03%	.19%	.12%	15
Below-Cost Timber Sales - How much money will Forest timber sales lose annually, what employee income is *dependent on those timber sales and how much Federal* Income Tax is paid by those employees?						
Net Timber Receipts	-$1,140,000	-$585,000	-$597,000	-$1,822,000	-$1,040,000	-$1,253,000
Dependent Employee Income	$4,035,000	$2,513,000	$2,113,000	$9,876,000	$8,603,000	$8,603,000
Federal Income Tax Paid	$605,000	$377,000	$316,950	$1,481,000	$1,290,000	$1,290,000
New Roads - How many miles of new roads will be constructed annually to support the timber program?						
Annual Miles Constructed	24	11	9	41	24	29
Timber Cutting in unroaded Areas - How many timber harvest acres will occur in RARE II lands which have not been developed for timber or other multiple uses?						
Timber Harvest Acres/Year	301	213	125	1024	448	481
Timber Cutting and Livestock - Different timber production levels will not affect domestic livestock production levels as increased forage created by timber sales is considered temporary forage and is not used to increase permitted livestock	No Change	No Change	No Change	No Change	No Change	No Change
Timber and Recreation Resources - Timber harvesting may enter a number of highly scenic areas and alter these landscapes	Some Highly Scenic Areas Entered	No Change	No Change	Most Highly Scenic Areas Entered	No Change	Some Highly Scenic Areas Entered

TABLE II-2 RESPONSE OF ALTERNATIVES TO ISSUES (continued)

Alternative (across) Issue (down)	1A	1C	1D	1E	1G	1H
Timber and Tourism Economy - The tourism industry has grown along side the timber industry for more than forty years and continues to grow and be healthy Evidence from traffic counts, total Forest recreation use, and growth in the tourism sector indicates timber harvesting will not have a negative effect on the tourism industry	No Change	No Change	No Change	No Change	No Change	No Change
Biodiversity - Differences in acres harvested by alternative create different age classes over time and increase diversity	Moderate Increase In Diversity	Least Increase In Diversity	Least Increase In Diversity	Highest Increase In Diversity	Moderate Increase In Diversity	Highest Increase In Diversity
Old Growth - Increasing harvest levels mean a smaller proportion of the Forest will be in old growth, although timbered areas will still have at least 10% old growth	Moderate Decrease In Old Growth	Least Decrease In Old Growth	Least Decrease In Old Growth	Highest Decrease In Old Growth	Moderate Decrease In Old Growth	Highest Decrease In Old Growth
Riparian Areas Protection - All riparian areas will be protected from timber harvesting, see Forest Plan Amendment 9A management prescription	No Change	No Change	No Change	No Change	No Change	No Change
Insect and Disease Control - Timber harvesting can reduce the risk of insect and disease outbreaks by favoring younger trees which are more resistant	Moderate Decrease In Insect & Disease Risk	No Change	No Change	Highest Decrease In Insect & Disease Risk	Moderate Decrease In Insect & Disease Risk	Highest Decrease In Insect & Disease Risk
Visuals Impacts of Harvest - None of the alternatives will change the Visual Quality Objectives of the Forest, however timber harvesting can reduce on-site visual quality as forest stands become timber sales	Moderate Decrease In On-Site Visual Quality	Least Decrease In On-Site Visual Quality	Least Decrease In On-Site Visual Quality	Highest Decrease In On-Site Visual Quality	Moderate Decrease In On-Site Visual Quality	Highest Decrease In On-Site Visual Quality
Soil and Water - Timber harvesting and road construction can cause erosion and put sediment in nearby streams with road construction being the major contributor of sediment	No Change	No Change	No Change	Highest Increase In Risk	Some Increase In Risk	Highest Increase In Risk

Timber Program

Lands Considered "Suited" for Commercial Timber Production

In developing the alternatives all forested lands were examined to determine if they were suitable for timber production (See chapter III- and Appendix B, page B-9) The FSEIS identified 1,253,543 acres of forested land classified as "tentatively suited" for commercial timber production

Next, the lands needed for commercial timber production in each alternative were chosen from the "tentatively suited" acres These lands became known as "lands suited for timber production" or "suited" acres. The suited acres were determined on a basis of combined effect of the goals of each alternative plus an assessment of relative efficiency of different timber lands. The amounts and kinds of acres needed for each alternative are shown in Table II-3 and Figure II-1.

TABLE II-3

LAND SUITED FOR TIMBER PRODUCTION BY ALTERNATIVE

	Alternatives					
	1A	1C	1D	1E	1G	1H
Conifer	336,526	287,601	163,470	596,589	380,813	380,813
Aspen	25,972	281	36,733	284,534	169,318	241,153
TOTAL	362,498	287,882	200,203	881,123	550,131	621,966

(Tentatively Suited 1,253,543)

Allowable Sale Quantity

The goals and objectives developed for each alternative provide the basis for the constraints used in the FORPLAN model used to determine the average volume of timber available for harvest by planning period (See Appendix B) Resource management objectives, acres of suited land, and the silvicultural activities applied determine the volume produced by product category Table II-4 displays the average annual allowable sale quantity by alternative for each ten year time period Figure II-2 displays the six alternatives and their abilities to meet expected demand in the first decade

No alternative meets all wood fiber demand Alternative 1E meets 100% of sawtimber demand. No alternative meets 100% of waferwood demand.

The following tables and figures summarize the changes in management emphasis between the original and the amended Forest Plans as well as the difference in outputs and effects between Forest Plan Amendment alternatives

Table II-5 displays the management area emphasis allocations, their acreages, and the acres of suited timber lands for the preferred alternative for both aspen and conifer by management area

Table II-6 presents the estimated quantifiable resource outputs, environmental effects, activities, and costs for each of the alternatives

Table II-7 is a summary comparison of alternatives in terms of environmental effects.

Figure II-1 displays the allowable sale quantity by alternative

Figure II-2 displays suited timber acres by alternative

TABLE II-4

ALLOWABLE SALE QUANTITY BY ALTERNATIVE
ANNUAL ASQ MMCF/DECADE (MMBF/DECADE)

ALTERNATIVE	*DECADE 1*	*DECADE 2*	*DECADE 3*	*DECADE 4*	*DECADE 5*
1A					
Sawtimber	7.000	7.000	7.000	7.000	7.000
POL	*.875*	*.875*	*.875*	*875*	*875*
Total	7.875	7 875	7.875	7.875	7.875
(MMBF)	(35.000)	(35.000)	(35.000)	(35.000)	(35.000)
1C					
Sawtimber	4.359	4 419	6.578	6 578	6 578
POL	*0 000*	*0 000*	*0 000*	*0.000*	*0.000*
Total	4.359	4.419	6.578	6.578	6 578
(MMBF)	(19 614)	(19 885)	(29.601)	(29 601)	(29.601)
1D					
Sawtimber	3 666	3 666	3.666	3 666	3.666
POL	*.616*	*.616*	*.616*	*.616*	*.616*
Total	4.282	4 282	4 282	4.282	4.282
(MMBF)	(18 961)	(18 961)	(18 961)	(18.961)	(18.961)
1E					
Sawtimber	6.874	6 874	11 282	11.282	12.282
POL	*7 627*	*8.128*	*8 128*	*8 128*	*8.128*
Total	14.501	15.002	19.410	19 410	20.410
(MMBF)	(61.441)	(63.445)	(83.280)	(83 280)	(87.782)
1G					
Sawtimber	4.667	4.667	6.578	6.578	6 578
POL	*4 460*	*4.961*	*4 961*	*4 961*	*4 961*
Total	9.127	9.628	11.539	11 539	11 539
(MMBF)	(38.840)	(40.844)	(49 445)	(49.445)	(49 445)
1H					
Sawtimber	4.667	4.667	6 578	6.578	6.578
POL	*6 210*	*6 711*	*6 711*	*6 711*	*6 711*
Total	10 877	11.378	13.289	13.289	13 289
(MMBF)	(45 840)	(47.844)	(56.445)	(56.445)	(56 445)

TABLE II-5 MANAGEMENT AREA SUMMARY (INCLUDING SUITED TIMBER LANDS)

Management Area	Emphasis	Total Acres	Suited Aspen	Suited Conifer	Total Suited Lands
1A	Developed Recreation Sites.	1,117	0	0	0
1B	Downhill skiing and winter sports.		14,253	0	0
1D	Utility corridors and electronic sites	4,535	0	0	0
2A	Semi-primitive motorized recreation opportunities.	330,508	5,649	29,199	34,848
2B	Roaded natural and rural recreation opportunities	51,516	625	6,894	7,519
3A	Semi-primitive non-motorized recreation opportunities.	81,435	525	580	1,105
4B	Wildlife habitat management for one or more management indicator species.	240,595	14,275	19,753	34,028
4D	Aspen management.	61,108	25,752	16,726	42,478
5A	Big game winter range in non-forested areas	212,754	3,238	6,434	9,672
5B	Big game winter range in forested areas	23,579	6,773	5,146	11,919
6A	Livestock grazing -- improve forage composition.	1,001	1,522	66	1,588
6B	Livestock grazing -- maintain forage composition	829,760	77,165	65,233	142,398
7A	Timber management on slopes under 40%.	549,591	30,816	230,782	261,598
8A	Pristine wilderness setting	105,475	0	0	0
8B	Primitive wilderness setting.	185,464	0	0	0
8C	Semi-primitive wilderness setting		176,278	0	0
9A	Riparian area management.	25,826	0	0	0
10A	Research Natural Areas.	1,461	0	0	0
10C	Special Interest Areas, Cultural Areas, and National Natural Landmarks.	1,061	0	0	0
10E	Municipal watersheds	7,440	2,979	0	2,979
	TOTALS *	2,905,027	169,318	380,813	550,131

*2,953,186 acres are contained within the procalimed National Forest Adjacent National Forests manage 88,901 acres of this Forest's wilderness while the GMUG manages 40,742 acres of adjacent Forests' wilderness. Therefore, the GMUG manages 2,905,027 acres.

QUANTIFIABLE RESOURCE OUTPUTS, ENVIRONMENTAL EFFECTS, ACTIVITIES AND COSTS BY ALTERNATIVE

TABLE II-6

OUTPUT/EFFECT	UNITS	1A	1C	1D	1E	1G	1H
SUITED LANDS BY SPECIES							
Spruce/fir	Acres	274,807	255,899	128,135	419,864	216,717	216,717
Ponderosa pine	Acres	9,365	796	14,946	76,481	74,730	74,730
Lodgepole pine	Acres	52,354	30,906	20,389	100,244	89,366	89,366
Aspen	Acres	25,972	281	36,733	284,534	169,318	241,153
TOTAL	Acres	362,498	287,882	200,203	881,123	550,131	621,966
ASQ BY NON-INTERCHANGEABLE COMPONENT (NIC)(*See Glossary*)							
Sawtimber	MCF/Yr	7,000	4,359	3,666	6,874	4,667	4,667
Conifer POL	MCF/Yr	0	0	0	610	610	610
Aspen POL	MCF/Yr	875	0	616	5,217	3,700	4,620
High Cost Aspen POL	MCF/Yr	0	0	0	1,800	150	980
Sawtimber	MBF/Yr	31,500	19,600	16,500	31,000	21,000	21,000
Conifer POL	MBF/Yr	0	0	0	2,400	2,400	2,400
Aspen POL	MBF/Yr	3,500	0	2,400	20,900	14,800	18,500
High Cost Aspen POL	MBF/Yr	0	0	0	7,200	600	3,900
TOTAL	MCF/Yr	7,875	4,359	4,282	14,501	9,127	10,877
	MBF/Yr	35,000	19,600	18,900	61,500	38,800	45,800
LONG TERM SUSTAINED YIELD	MCF/Yr	11,277	9,354	7,869	23,840	14,083	15,833
	MBF/Yr	50,070	41,532	34,938	105,850	62,529	70,299

TABLE II-6 (continued)

OUTPUT/EFFECT	UNITS	1A	1C	1D	1E	1G	1H
ACRES TREATED BY SILVICULTURAL METHOD IN DECADE ONE							
Clearcut							
Aspen	Acres/Yr	310	0	489	2,797	1,376	2,006
Lodgepole pine	Acres/Yr	1,186	0	0	733	733	733
TOTAL	Acres/Yr	1,496	0	489	3,530	2,109	2,739
Shelterwood							
Spruce-fir	Acres/Yr	6,600	6,091	0	7,308	4,551	4,551
Ponderosa pine	Acres/Yr	486	0	0	667	667	667
TOTAL	Acres/Yr	7,086	6,091	0	7,975	5,218	5,218
Selection.							
Spruce-fir	Acres/Yr	0	0	3,092	0	0	0
TOTAL - ALL METHODS	Acres/Yr	8,582	6,091	3,581	11,505	7,327	7,957
WATER							
Baseline Yield	M AC FT/Yr	2,866	2,866	2,866	2,866	2,866	2,866
Yield Above Baseline	M AC FT/Yr	13 1	7.5	1 0	17.4	11.1	12.4
FACILITIES							
New Local Road Construction	Miles/Yr	24	11	9	41	24	29
Local Road Reconstruction	Miles/Yr	25	15	10	39	23	26
ROADLESS AREAS Percentage of RARE II Areas Planned for Entry, Decade One	%/Decade	3 2%	8 6%	3 8%	10.9%	4 7%	5 4%

TABLE II-6 (continued)

OUTPUT/EFFECT	UNITS	1A	1C	1D	1E	1G	1H
PRESENT NET VALUE (150 YEARS @ 4% Discount Rate)							
Direct Timber	$MM	-20 559	-11.324	-13 690	-41.600	-22.869	-27.871
Increased Water Yield	$MM	17 268	12.540	983	26 523	16.291	17.438
TOTAL TIMBER	$MM	-3 291	1.216	-12 707	-15 077	-6 578	-10.433
RETURNS TO TREASURY							
Decade One, Timber Only	$MM/Yr	.194	192	.095	.323	.194	.222
PAYMENTS TO COUNTIES FROM 25% GROSS RECEIPTS							
Decade One, Timber Only	$MM/Yr	.173	119	.102	.259	.168	.187
CHANGES IN EMPLOYMENT & INCOME		*	*	*	*	*	*
NET TIMBER RECEIPTS							
First Decade	$MM/Yr	-1 140	-.585	- 597	-1 822	-1.040	-1 253
First 50 Years	$MM/Yr	- 695	- 361	-.547	-1 572	-.835	-1.029
BUDGET COST							
Operational Costs	$MM/Yr	939	.625	684	1.338	.885	.995
Capital Investment Costs	$MM/Yr	891	.437	.323	1.518	827	1.007
TOTAL COST	$MM/Yr	1 830	1.062	1.007	2 856	1.711	2 002
TIMBER RELATED COST							
Fixed Timber Cost	$MM/Yr	.160	.160	.160	160	160	160
Variable Timber Cost	$MM/Yr	779	.465	.524	1 178	.725	.835
Road Construction Cost	$MM/Yr	.891	.437	323	1 518	827	1 007
TOTAL TIMBER COST	$MM/Yr	1 830	1.062	1 007	2 856	1.711	2 002

Legend
MCF/Yr - Thousand Cubic Feet of woodfiber per year
MBF/Yr - Thousand Board Feet of woodfiber per year
$MM/Yr - Millions of 1982 Dollars per year

* - Changes in jobs and income require more explanation than is appropriate in Table II-6 See Table II-10 and the employment & income discussion beginning on page II-38 for more information

COMPARISON OF THE ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES

TABLE II-7

1 2 3 4 5
More beneficial------->No change------>More adverse
(Numbers should be compared across in rows, not vertically in the columns)

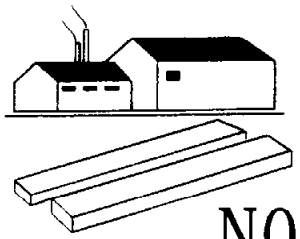
RESOURCE	1A	1C	1D	1E	1G	1H
Biological Diversity						
Genetic Diversity	3	3	3	3	3	3
Species Diversity	4	3	2	5	3	4
Community Diversity	3	4	5	2	3	3
Forest Vegetation						
Vertical Diversity						
Aspen	3	2	3	5	3	4
Conifer	4	4	1	5	3	3
Horizontal Diversity						
Aspen	3	3	3	1	3	2
Conifer	1	3	3	2	2	2
Old Growth						
Aspen	3	3	3	5	4	4
Lodgepole Pine	5	3	3	4	4	4
Ponderosa Pine	4	3	3	5	5	5
Spruce-Fir	4	4	3	5	4	4
Timber						
Forest Growth and Yield						
Regeneration	3	4	4	3	1	2
Climate	3	3	3	3	3	3
Soils	3	3	3	5	4	5
Air Quality	3	3	3	3	3	3
*Water Yield	2	2	3	1	2	2
Water Quality	3	3	3	5	3	4
Range Resources	3	3	3	2	3	2
Unroaded Areas	3	3	3	5	4	4
**Visuals/Scenery	4	2	1	5	4	5

TABLE II-7 (Continued)

*Recreation Opportunities						
Primitive	3	3	3	3	3	3
Semi-Primitive Non-Motorized	4	3	3	5	4	4
Semi-Primitive Motorized	3	4	4	2	3	3
Roaded Natural	3	4	4	1	2	2
Rural	3	3	3	3	3	3
Wildlife and Fish						
Management Indicator Species						
Aspen	3	3	3	5	4	5
Conifer	5	4	3	5	4	4
Habitat Effectiveness and Effects on Big Game Movement						
Aspen	2	1	3	5	4	5
Conifer	5	4	4	5	4	4
Riparian						
Aspen	1	1	1	5	3	4
Conifer	4	2	2	5	3	3
Aquatic Resources	3	2	2	4	3	3
Threatened and Endangered Species	3	3	3	3	3	3
Forest Pest Management	2	4	4	1	3	3
Wildfire						
Short-term Effects	4	2	2	5	3	3
Long-term Effects	2	4	4	1	3	3
Economics (Forest Costs vs. Revenues)						
Aspen	4	5	4	1	2	3
Conifer	2	3	4	2	3	3
Economic and Social Environment						
Direct economic relationships	3	4	4	1	4	2
Esthetic and ammenity ties	3	2	2	5	3	4

* Numerical ratings are based on amount of increase, 1 being the greatest increase and 5 being the greatest decrease. (Increase doesn't necessarily mean beneficial)

** Numerical ratings are based on amount of change from the present management practices rather than on a scale of more beneficial to more adverse.



ALLOWABLE SALE QUANTITY BY ALTERNATIVE BY NON-INTERCHANGEABLE COMPONENT

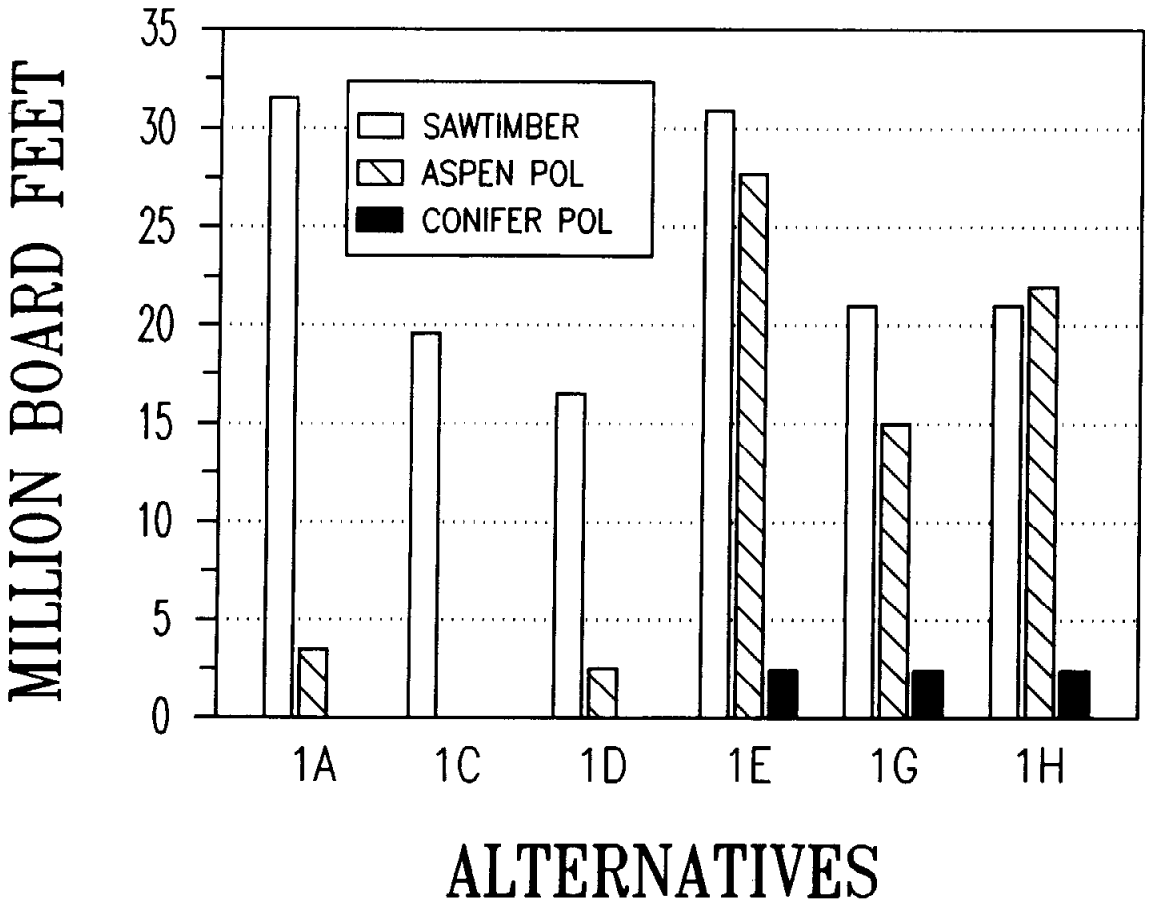
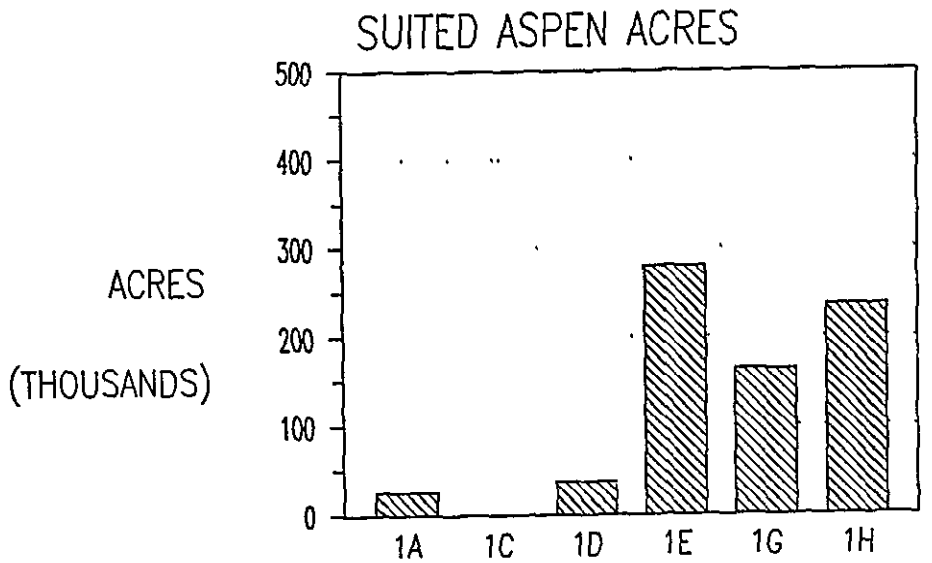


Figure II-1

Figure II-2

Suited Timber Acres By Alternative



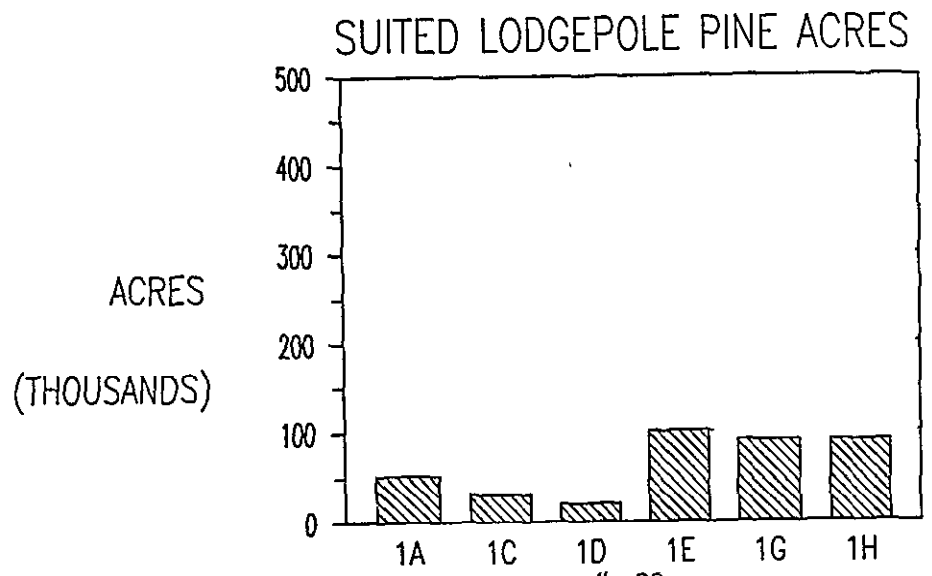
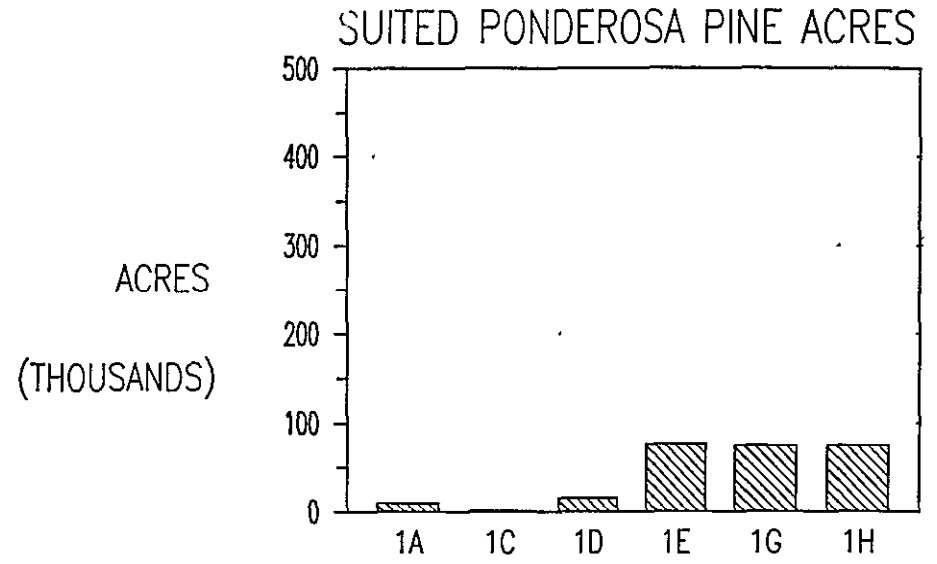
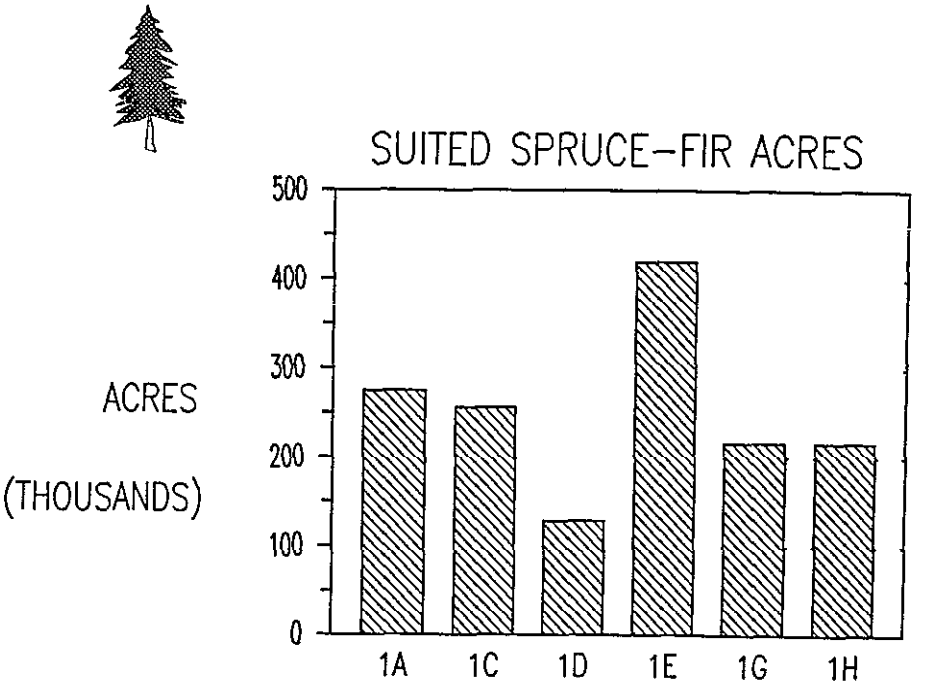


Figure II-2 Continued





ECONOMIC COMPARISONS AND TRADEOFFS BETWEEN ALTERNATIVES

INTRODUCTION

This section compares the economic outputs and effects of the alternatives as a step toward identifying the alternative that best enhances net public benefit while responding effectively to the issues An economic efficiency analysis is required by the National Forest Management Act Regulations (36 CFR 219) and has been important to the development and evaluation of the alternatives This section explains the key concepts and terminology of the economic efficiency analysis and discusses the economic implications of the alternatives These implications are also displayed in a series of tables that present incremental changes in PNV, costs, and benefits Other economic and social effects are also discussed in this section. These include the Forest Service budget, returns to the U.S. Treasury, and impacts of the alternatives on local communities

OVERVIEW OF KEY CONCEPTS

Appendix B, Section IV, Economic Efficiency Analysis, provides a complete discussion of the concepts related to economic analysis.

Present net value (PNV) is a quantitative or dollar measure of economic efficiency PNV is defined as the difference between the discounted value of all priced outputs (benefits) minus all the fixed and variable costs associated with managing the forest Maximum PNV was a criterion used to help ensure that each alternative consisted of the most economically efficient combination of priced outputs and management activities that were needed to meet multiple-use objectives

Discounted benefits and costs included in the timber PNV analysis in Table II-8 and throughout the FSEIS include the values for both timber and increased water yield. Because domestic livestock grazing, hunting & fishing, recreation and background water yield benefits are essentially the same in each alternative, these and other non-timber-related multiple use costs and benefits were treated as constants in each alternative (See Page II-52) Since these were constants, they were removed from the analysis As a result, the measures of PNV used in the FSEIS are only partial measures of PNV. The partial PNVs include only the costs and benefits associated with timber production. The partial PNVs make the comparison of alternatives easier and better address the issues

Net public benefits (NPB) are estimated, in part, by PNV However, PNV provides an incomplete estimate of NPB since nonpriced outputs and other important effects are not included among the priced benefits

Calculating PNV involves "discounting " Discounting is a process which allows the comparison of future costs and benefits in a way that makes them comparable to present dollar values. As a result of this process, the discounted net benefit may be referred to as the present net value. The discount rate used for these calculations is 4 percent A 150-year period was used to make the calculation; however, the benefits and costs in the first 50 years have the most significant effect on the PNV since the discount factor is much larger in the later time periods.

Priced Outputs

Priced outputs are those outputs exchanged in the marketplace. The quantitative or dollar values for priced outputs fall into the categories of market or nonmarket The market value constitutes the unit price of an output normally exchanged in a market. Market value is what people are willing to pay as evidenced by actual sales transactions. Timber, forage, and minerals are examples of commodities which are bought and sold in the market. The value of these products is estimated by using comparable sales transaction data. Nonmarket output values used in the analysis were based on "estimated market prices." Water and recreation are examples of nonmarket values.

The analysis used two different benefit values --- water augmentation (nonmarket value) and timber harvesting (market value) The water augmentation value was obtained from a study specific to the Forest (Brown, 1988). Timber values were based on historic price levels (See FSEIS Appendix B Section IV)

Timber and water were the most important priced outputs used during the development of the alternatives. Together they accounted for all of the total discounted variable benefits associated with the alternatives. They were treated as roughly equal in importance (See Table II-8)

Non-Priced Outputs

Nonpriced outputs are outputs which have no available market transaction evidence. Thus, they have no reasonable basis for estimating a dollar value commensurate with the market value associated with the priced outputs. This situation requires that subjective nondollar or qualitative values be attributed to output production. These values may be either positive or negative. In fact, an output one person considers a benefit may represent a cost to another person.

Some examples of important nonpriced outputs and effects are managing important visual scenes, reducing damage risk from insects, disease, and wildfire, and community growth and development

In some cases the importance of providing nonpriced benefits can outweigh the advantages of producing higher levels of priced benefits. Many of the nonpriced benefits are provided for by applying constraints to the production of priced outputs (such as timber harvesting constraints in FORPLAN). These constraints usually result in a decrease in the PNV of the priced outputs. Subjective judgements must be made in assessing whether the benefits of producing the nonpriced outputs are greater than the costs associated with producing fewer priced outputs If a PNV tradeoff created through a nonpriced output is acceptable, a positive contribution to NPB results and the alternative is more efficient

The nonpriced outputs can be influenced by decisions about Forest management. These nonpriced ouputs are often the topic of one or more of the issues and concerns identified at the beginning ofthe planning process The outputs function as nonpriced indicators of response to the issues for the alternatives While the quantitative dollar values of these cannot be determined, nonpriced outputs can generally be evaluated by examining such quantitative indicators as acres of appropriate allocations, resource outputs, or timber-production-related activities and outputs.

Distribution Effects

In addition to economic efficiency, the distribution effects of forest management must be assessed. These effects would include local and regional employment and income, payments to counties in lieu of taxes, and effects on user groups who may benefit from increased outputs but who pay no or nominal fees With a wide range of alternatives, differences may be expected in the distribution of program benefits and costs among the parties affected by forest management The effects would be related to questions of equity (i e , who pays and who benefits) rather than efficiency so would not be assessed in the context of the efficiency criteria associated with the PNV and net public benefit concepts. However, positive and negative distributive effects are here assessed in conjunction with the net public benefit measures since equity objectives often influence efficiency objectives and vice versa.

ECONOMIC COMPARISONS

Differences in Present Net Value Among Alternatives

As noted in the concepts section, PNV is the primary quantitative measure of economic efficiency for each alternative and provides a partial estimation of net public benefits resulting from the Forest's timber program As defined, PNV is the sum of market and nonmarket benefits (priced outputs) minus the sum of all costs incurred in realizing the benefits, discounted to the present with a discount rate of 4 percent A higher PNV often means a greater total NPB, unless this is modified by net nonpriced outputs.

Several different measures of PNV are presented in the tables in Chapter II as well as throughout the FSEIS These are. Total Timber PNV, Timber PNV, and Increased Water Yield PNV

The PNV of Increased Water Yield is simply the present value of water augmentation from timber sales Increased Water Yield PNV presents the value of additional water coming off the Forest as a result of timber sales over the next 150 years.

Timber PNV is the net value of timber receipts and timber costs. Timber PNV provides the cash value of timber logged on the Forest over the next 150 years It can be considered a discounted timber revenue.

Total Timber PNV is the sum of Timber PNV and Increased Water Yield PNV Total Timber PNV is the total value of the Forest's timber program over the next 150 years expressed as net cash receipts and water production.

Table II-8 summarizes timber benefits, costs, and PNV for the alternatives and the Maximum Efficiency Benchmark (Benchmark 3A) Costs and benefits reflect timber production and water augmentation, the two resource production levels which change among the alternatives

Table II-13 summarizes the outputs and effects for easy comparison and presents the same information as the alternative descriptions beginning on page II-11.

The PNV of the alternatives range as follows:

		High	Low
Total timber PNV	MM 82 $	1	- 15
Timber PNV	MM 82 $	- 11	- 42
Increased Water Yield PNV	MM 82 $	27	1

Total Timber PNV (See Table II-8)

Alternative 1E has the largest discounted benefits and costs among the alternatives Alternative 1D has the lowest discounted benefits and costs *Decreasing Total Timber PNV does not correlate well with decreasing timber* volume (See Table II-6). The progressive decline in Total Timber PNV from Alternative 1C to Alternative 1E is due, instead, to a combination of effects Alternative 1C would cut mostly spruce/fir (100% spruce fir in decade 1) on the Forest's best timber lands and is the most efficient of the alternatives. Alternative 1A would also harvest over half of its decade-one timber volume as spruce/fir but this alternative would demand use of the more-expensive lower-productivity sites on the Forest to maintain a higher level of timber production than Alternative 1C Alternative 1G would have a similar conifer harvest level as Alternative 1C, but this alternative would log four times the amount of aspen Alternative 1G would be limited to producing timber on the Forest's best timber lands Alternative 1H is identical to Alternative 1G except for an additional 630 acres of aspen that would be logged each year. Alternative 1H would demand that the more-expensive lower-productivity sites on the Forest be used to harvest the additional aspen Alternative 1D would have the lowest timber harvest level and the second lowest PNV The relatively low PNV of Alternative ID is caused by selection harvesting in spruce/fir (a relatively costly method) and the lack of water augmentation benefits from spruce/fir selection harvesting.

Timber PNV (See Table II-8)

Except for Alternative 1D the ranking of alternatives by Timber PNV is the same as the ranking by Total Timber PNV The Alternative 1D Total Timber PNV is the second lowest, while the Alternative 1D Timber PNV is the second highest. The change is due entirely to the low water yield produced by selection timber harvesting in Alternative 1D.

Increased Water Yield PNV (See Table II-8)

Alternative 1E has the greatest Increased Water Yield PNV, and Alternative 1D has the lowest Increased Water Yield PNV is directly related to the number of *acres of spruce-fir, lodgepole pine, and aspen which are logged by clearcuts or* shelterwood cuts

Alternative 1E has the highest water yield PNV because it cuts the most timber using methods which increase water yield Alternative 1D has the lowest water yield PNV because it concentrates on selection harvesting which does not produce a water yield. Alternative 1D is the only alternative which uses the selection timber harvest method.

Alternative 1H has the second highest water yield PNV and the second highest timber harvest level.

Alternatives 1G and 1A have similar water PNVs with 1A being greater even though its timber harvest level is slightly lower than 1G. Alternative 1A concentrates timber harvesting in spruce/fir and lodgepole pine which produce a greater water yield than aspen harvesting. Alternative 1G has a more balanced timber harvest program between spruce/fir, lodgepole pine and aspen at the sacrifice of reduced water yield.

Alternative 1C has the second lowest water yield PNV and the lowest timber harvest level of the alternatives which use timber harvest prescriptions to increase water yields.

CHANGING ASPEN POL TIMBER PRICES

An important issue addressed in this FSEIS is whether or not the Forest will increase timber prices to the point the Forest's timber program no longer loses money While sawtimber price increases are being analyzed at the Regional level, the region has delegated authority to increase aspen POL prices to the Forest level. Changing aspen POL prices would effect both the annual net timber revenue and the PNV

Tables II-10 and II-11 display the effects of aspen POL price increases on net timber revenue and PNV. These tables consider the current aspen POL price, the aspen POL break-even price for Alternative 1G, and two intermediate price increases between the current price and the break-even price.

TABLE II-8 PNV and DISCOUNTED BENEFITS & COSTS OF TIMBER OUTPUTS
Millions of 1982 Dollars

		Discounted Benefits @ 4%			Discounted Costs @ 4%		
Alt	Present Net Value	Timber	Water	Total	Timber	Roads	Total
BMK	2,827,688	26,703,470	21,739,528	48,442,998	31,516,276	14,099,034	45,615,310
1C	1,215,848	14,792,162	12,539,501	27,331,663	19,019,641	7,096,175	26,115,815
1A	-3,291,449	18,156,851	17,267,688	35,424,539	24,890,389	13,825,598	38,715,987
1G	-6,578,331	20,050,118	16,291,158	36,341,276	25,729,935	17,189,671	42,919,607
1H	-10,433,002	22,005,574	17,437,801	39,443,375	28,489,029	21,387,347	49,876,376
1D	-12,707,245	10,248,104	982,809	11,230,913	17,107,868	6,830,290	23,938,157
1E	-15,076,933	32,915,371	26,523,468	59,438,840	41,431,146	33,084,628	74,515,773

TABLE II-9 TIMBER AVERAGE ANNUAL CASH FLOWS BY ALTERNATIVE IN DECADES 1 THROUGH 5
(In order of decreasing net timber receipts - millions of 1982 dollars)

	Decade 1			Decade 2			Decade 3		
	Net Timber Receipts	Timber Costs	Timber Receipts	Net Timber Receipts	Timber Costs	Timber Receipts	Net Timber Receipts	Timber Costs	Timber Receipts
1C	-584,605	1,062,357	477,752	-578,290	1,062,649	484,359	-317,331	1,038,346	721,015
1D	-597,250	1,006,847	409,597	-567,268	976,865	409,597	-613,231	1,022,828	409,597
BMK	-742,783	1,353,301	610,518	-906,971	1,644,554	737,583	-852,929	2,283,594	1,430,665
1G	-1,039,561	1,711,221	671,660	-1,090,210	1,786,504	696,294	-768,255	1,701,988	933,733
1A	-1,140,149	1,830,280	690,131	-1,070,066	1,761,969	691,903	-474,155	1,233,871	759,716
1H	-1,253,250	2,002,313	749,063	-1,300,763	2,074,459	773,696	-977,602	1,988,738	1,011,136
1E	-1,821,644	2,855,856	1,034,212	-1,842,063	2,900,909	1,058,846	-1,620,335	3,190,238	1,569,903

	Decade 4			Decade 5			50 Year Average		
1C	-310,493	1,030,929	720,436	-14,645	733,524	718,879	-361,073	985,561	624,488
1D	-587,575	974,386	386,811	-368,856	778,453	409,597	-546,836	951,876	405,040
BMK	-710,234	2,144,358	1,434,124	-166,942	1,832,126	1,665,184	-675,972	1,851,587	1,175,615
1G	-792,691	1,725,841	933,150	-482,282	1,421,200	938,718	-834,640	1,669,351	834,711
1A	-529,178	1,288,894	759,716	-259,956	1,019,672	759,716	-694,701	1,426,937	732,236
1H	-978,910	1,989,462	1,010,552	-634,002	1,650,122	1,016,120	-1,028,906	1,941,019	912,113
1E	-1,629,102	3,198,422	1,569,320	-946,472	2,631,043	1,684,571	-1,571,923	2,955,294	1,383,370

Table II-10

EFFECTS OF POSSIBLE ASPEN POL[1] PRICE CHANGES ON THE *TOTAL* TIMBER PROGRAM

POL Prices in 1982 Dollars [2]	Alternative 1A MM$/Year	Alternative 1C MM$/Year	Alternative 1D MM$/Year	Alternative 1E MM$/Year	Alternative 1G MM$/Year	Alternative 1H MM$/Year
$44 23/MCF (Current Price)	-$ 1 140[3] -$ 20 559[4]	-$ 585 -$11 324	-$ 597 -$13 690	-$ 1 822 -$41 600	-$ 1 040 -$22 869	-$ 1 253 -$27 871
$101 56/MCF	-$ 1 090 -$19 292	-$ 585 -$11 324	-$ 562 -$12.794	-$ 1 384 -$30 062	-$ 784 -$15 918	-$ 897 -$27.871
$126 90/MCF	-$ 1.068 -$18 732	-$ 585 -$11 324	-$ 546 -$12 397	-$ 1 191 -$24 962	-$ 671 -$12 845	-$ 740 -$27 871
$152 23/MCF	-$ 1 046 -$18.172	-$ 585 -$11 324	-$ 531 -$12 001	-$ 998 -$19 864	-$ 558 -$ 9 774	-$ 583 -$ 27 871

Table II-11

EFFECTS OF POSSIBLE ASPEN POL PRICE CHANGES ON THE *ASPEN* TIMBER PROGRAM

POL Prices in 1982 Dollars [2]	Alternative 1A MM$/Year	Alternative 1C MM$/Year	Alternative 1D MM$/Year	Alternative 1E MM$/Year	Alternative 1G MM$/Year	Alternative 1H MM$/Year
$44 23/MCF (Current Price)	-$ 092[3]	-$ 000	-$ 086	-$ 878	-$ 407	-$ 636
$101 56/MCF	-$ 042	-$ 000	-$ 051	-$ 476	-$ 187	-$ 315
$126 90/MCF	-$ 020	-$ 000	-$ 035	-$ 298	-$ 089	-$ 173
$152 23/MCF	**+$ 002**	-$ 000	-$ 019	-$ 121	**+$ 009**	-$ 031

[1]POL--Products Other Than Logs Timber volume measured for products other than lumber, such as waferwood.

[2]The POL high-bid prices per MCF listed above are equivalent to the following per MBF base[5] rate prices in current dollars

1982 Dollars	1989 Dollars
$44 23/MCF	$ 6.00/MBF Base Rate
$101 56/MCF	$17 00/MBF Base Rate
$126 90/MCF	$25 00/MBF Base Rate
$152 23/MCF	$33.00/MBF Base Rate

[3]Decade one average annual net timber revenue.

[4]Discounted net timber revenue over 150 years (Timber PNV).

[5]The minimum amount of cash a timber purchaser can pay for a timber sale.

Table II-9 shows that all the alternatives still have annual negative net timber revenues. The reason for this is that all the alternatives have a conifer program which loses money and forces the total program below-cost (A method of increasing net sawtimber revenue Region Wide is currently being developed by the Regional Office in Denver, Colorado but will not be examined here) Alternative 1C is unaffected by the change in POL prices because Alternative 1C does not harvest POL.

Increasing POL price does have a positive effect on net timber revenue. Net timber revenue would increase Alternative 1G from an annual loss of over $1,000,000 to a loss of less than $800,000 with the first price increase ($17/MBF base rate), and to less than $600,000 with the last price increase.

Table II-10 displays how increasing aspen POL prices would eventually make aspen net timber revenue positive under Alternatives 1A and 1G.

The minimum rate levels are hypothetical. The ability of local industry to absorb the proposed increases is also unknown.

DIFFERENCES IN DISCOUNTED COSTS AMONG ALTERNATIVES

The costs included in the Timber PNV calculation in Table II-8 include all of the Forest's timber budget costs plus costs for timber purchaser road credit. Non-Forest Service costs such as logging, hauling, road maintenance, brush disposal, or erosion control are paid by timber purchasers and are not included Timber costs fall into two different categories timber and road construction/reconstruction/ maintenance costs Alternative 1E has both the highest total cost and highest timber harvest level; the lowest costs are in Alternative 1D which has the lowest timber harvest level Generally, the higher the timber harvest level, the higher the budget cost An exception to this is found in Alternatives 1A and 1G Alternative 1G has a higher timber harvest level but a lower budget cost than Alternative 1A Alternative 1A harvests timber from the more-expensive and less-productive timber lands on the Forest, while Alternative 1G does not Thus Alternative 1G has lower budget costs

DIFFERENCES IN DISCOUNTED BENEFITS AMONG ALTERNATIVES

Alternative 1E has the greatest discounted benefits while Alternative 1D has the smallest discounted benefits because of its low level of water augmentation Timber-related discounted benefits are directly related to the size of the timber program and the number of acres logged which contribute to an increased water yield. Alternative 1H has the second highest level of discounted benefits followed by Alternative 1G, 1A and 1C.

OTHER ECONOMIC EFFECTS

GOVERNMENT CASH FLOWS -- RECEIPTS AND BUDGETS

Another important economic consideration is the flow of dollars to and from the U S Treasury and the taxpayers of the United States. The important variables here are cash receipts and budget cost.

Net return to the U S Treasury, or "net cash flow," is defined as the difference between the dollar receipts expected and budget costs The major differences among the alternatives are net timber receipts, timber receipts, and timber costs Receipts from other uses, such as grazing and skiing, were assumed to be constant and were not included in the FSEIS. Table II-8 displays the variable direct timber costs, receipts, and net receipts by alternative for decades one through five, plus a fifty year average The alternatives are ranked in order of decreasing decade-one net cash flows Timber costs exceed timber receipts for all of the alternatives at current prices

ECONOMIC AND SOCIAL EFFECTS ON THE LOCAL COMMUNITIES

Introduction

The economy of the area has historically been tied to the National Forest through grazing, mining, logging, and, more recently, tourism Logging and the processing of forest products has remained at a relatively constant level while the overall population of the area has increased and diversified Thus, the local timber industry has become a smaller proportion of the economy. While the Forest's timber harvest program is not absolutely vital to community growth and development, the timber program does remain a significant contributor to the local economy

Changes in timber volume offered by the Forest have the potential to affect local employment and personal income levels In estimating the impacts of the alternatives, the economic base of an eight-county area was considered This base consisted of two economic impact areas (EIA) EIA 214 and EIA 215 EIA 214 includes Delta, Mesa, Montrose, Ouray, and San Miguel Counties EIA 215 includes of Gunnison, Hinsdale and San Juan Counties The largest sector within the area's economic base is mining Mining is followed by the services sector Forestry and other agriculture makes up less than 2% of the total income of EIAs 214 and 215. A majority (70%) of the wood purchased from the Forest in 1986 was purchased by mills in the Delta-Montrose area. Timber harvesting occurs throughout the Forest in both EIA 214 and EIA 215. Local timber mills are dependent on the Forest for wood EIA 215 does not, however, have a significant wood processing industry

Employment and Income

The key employment and income issue of the FSEIS is what effect the alternatives will have on a waferwood plant in the Delta-Montrose area. The loss of the plant would cost the local Delta-Montrose area approximately 350 jobs and $5,900,000 in employee income, roughly half the Forest's timber production industry. If all current timber jobs (at least 667 jobs -- the waferwood industry jobs plus sawtimber jobs based on the 1989 sawtimber harvest of 27 MMBF) were concentrated in the Delta-Montrose area, they would account for 3 5% of current employment in the Delta-Montrose Area. The Forest will not attempt to predict the minimum aspen harvest level needed to keep the waferwood plant open, but instead will identify the aspen harvest level of each alternative (See table II-11). The higher the aspen harvest level, the lower the risk that the waferwood plant will close

Adjoining Forests may be able to provide as many as 400 acres of aspen sales annually within a 120-mile distance of the Olathe waferwood plant. The additional acres may mean the difference between the plant staying open and the plant closing.

The alternatives also examine different levels of sawtimber production. Unlike the waferwood industry, the local sawtimber industry includes many different timber mills and Forest management decisions do not have an all-or-nothing risk associated with them The predicted job and income levels for the local sawtimber industry, ranked by the number of jobs provided by National Forest timber, is.

	SAWTIMBER JOBS	EMPLOYEE INCOME
1989 harvest	313	$3,458,700
Alternative 1A	366	$4,035,150
Alternative 1E	359	$3,962,517
Alternative 1G	244	$2,690,062
Alternative 1H	244	$2,690,062
Alternative 1C	228	$2,512,573
Alternative 1D	192	$2,113,266

The actual number of jobs gained or lost will depend on the ability of the local sawtimber industry to obtain logs from other sources

Payments to Local Governments

None of the alternatives will affect total (25% of gross receipts plus PILT) payments to Delta, Garfield, Mesa, Montrose, Ouray or San Juan Counties

The alternatives will affect total payments to Gunnison, Hinsdale, Saguache and San Miguel counties because PILT payments are calculated at ten cents per Federal acre without considering 25% of gross receipts payments Generally an increase or decrease in gross timber receipts (Table II-8) will increase or decrease payments to these counties, except for Gunnison County Gunnison county is on the boarder line between the two PILT calculation methods Alternatives 1C and 1D will change total Gunnison County payments to approximately a flat rate of $270,000 annually from all Federal lands

DISCUSSION OF TRADE-OFFS AND OPPORTUNITY COSTS BETWEEN ALTERNATIVES

The Alternatives are directed towards meeting different levels of demand for the various wood products produced on the Forest To achieve the timber demand objectives, other resource outputs must sometimes be limited or "traded off." Different "trade-off" arrangements result in different economic benefits and costs The change in net benefits (benefits minus costs) for individual resources between two alternatives is called the "opportunity cost" of an alternative.

Two resource outputs vary in terms of valued benefits between alternatives: 1) the level of timber management (and related activities) and 2) the amount of increased water flows that result from the various levels of timber management.

Table II-13 displays the quantitative effects on major issues and concerns of the FSEIS by alternative The alternatives are presented in order of decreasing Present Net Value, beginning with the Maximum PNV Benchmark (BM #3A without demand cut-off-points) Although Benchmark 3A is not considered a usable alternative, the Benchmark is useful for comparison purposes. By comparing the alternative with the highest Present Net Value against Benchmark 3A, the trade-offs and costs of the constraints used to represent an implementable alternative become clear

The following discussion focuses on both incremental timber and water production changes between alternatives and how the alternatives respond to the issues All other resource management programs were considered constant for the analysis. The discounted costs and benefits of the resources considered constant for all alternatives are listed below.

Resource	Discounted Benefits	Discounted Costs	Net Benefits
Recreation	596,842	58 447	538.395
Fish & Wildlife	412,212	24.792	387 420
Range	57,803	26.648	31 155
Timber	1.616	0	1.616
Soil & Water	2,469.804	5 290	2,464.514
Lands & Engineering	0	92.240	- 92.240
Other	0	77 199	- 77 199

(Costs & Benefits are in Millions of 1982 Dollars)

ISSUES & TRADEOFFS AMONG ALTERNATIVES

The analysis of tradeoffs among the alternatives compares each alternative to the alternative with the next highest total Present Net Value with respect to changes in how the significant issues (Planning Problems) are addressed The Planning Problems are compared with a set of "Indicators of Responsiveness" (See Table II-13) which are used to evaluate each alternative. The indicators of responsiveness and the analysis of tradeoffs among alternatives is presented below. Values presented in the tradeoff analysis have been rounded for ease of comparison

TABLE II-12 INDICATORS OF RESPONSIVENESS

ISSUE *	INDICATOR OF RESPONSIVENESS
Roadless areas (Planning Problem #2)	- Sensitive roadless areas developed in the first decade (See Chapter IV page IV-32) - New local road construction/reconstruction in the first decade
Timber demand (Planning Problem #8A)	- Sawtimber (percent of demand (Planning Problem #8A) supplied) - Conifer POL (percent of demand supplied) - Aspen POL (percent of demand supplied)
Commercial vs. non-commercial methods (Planning Problem #8B)	- The issue was resolved during the formulation of alternatives and does not vary by alternative (See page 11-10 on Alternative Treatment Methods)
Healthy forest (Planning Problem #8B)	- Acres treated in the first decade to reduce risk of insect and disease infestation and wildfire
Local community growth and development (Planning Problem #8D)	- Payments to counties from 25% of gross receipts were found to not significantly affect total payments to counties (See Chapter II-51) - Total employment - Total employee income
Timber sales for which costs exceed revenues (Planning Problem #8E)	- First decade net revenues from costs exceed revenues exceed revenues of the timber program - *Timber program average net revenues for the* first fifty years - Present Net Value (PNV) of discounted timber benefits and timber costs for the 150 year planning horizon - Break-even timber price
Aspen management (Planning Problem #8F)	- Acres of aspen classified as suited for timber production - Acres of aspen harvested (clearcut) in first decade - *Aspen POL (percent of demand supplied)*
Water (Planning Problem #10)	- Water yield above naturally-occurring levels - Water yield benefits (first decade) - Discounted water resource benefits over the planning horizon
Visuals (Planning Problem #17)	- Area maintained with a VQO of retention/partial retention Analysis determined Alternatives will not change VQO (See Chapter IV page IV-33)

* Planning problems #2 (Roadless Areas), #10 (Water), and #17 (Visuals) were identified during development of the original Forest Plan (FEIS, pages 10-14) Planning Problems #8A thru #8F were new issues identified during the scoping conducted for the Forest Plan amendment for which this Supplement was prepared

TABLE II-13 INDICATORS OF RESPONSIVENESS TO MAJOR ISSUES AND CONCERNS

(Alternatives ranked in order of decreasing PNV)

ALT.	Total PNV	Timber (only) PNV	Water Increase PNV	Decade 1 Net Timber Receipts	50 Year Net Timber Receipts	Suited Aspen Lands	Decade 1 Aspen Harvest	Decade 1 Local Road Const/Reconst	Roadless Areas
	MM 1982$	**MM 1982$**	**MM 1982$**	**MM 82$/YR**	**MM 82$/YR**	**M ACRES**	**M ACRES/YR**	**MILES/YR**	**% ENTERED**
BMK	2.828	-18.912	21.740	-0.743	0.676	79.385	.000	15/20	2.7
1-C	1.216	-11.324	12.540	-0.585	-0.361	.281	.000	11/15	2.3
1-A	-3.291	-20.559	17.268	-1.140	-0.695	25.972	.310	24/25	3.2
1-G	-6.578	-22.869	16.291	-1.040	-0.835	169.318	1.376	24/23	4.7
1-H	-10.433	-27.871	17.438	-1.253	-1.029	241.153	2.006	29/26	5.1
1-D	-12.707	-13.690	0.983	-0.597	-0.547	36.733	0.489	9/10	1.3
1-E	-15.077	-41.600	26.523	-1.822	-1.572	284.534	2.797	41/39	10.9

ALT	Decade 1 Water Increases	Decade 1 Water Increase Benefits	Decade 1 Insect & Disease Prevention		Percent of Timber Demand Supplied		
	M-AF/YEAR	**MM 82$/YEAR**	**LODGEPOLE AC/YEAR**	**PONDEROSA AC/YEAR**	**SAWTIMBER**	**CONIFER POL**	**ASPEN POL**
BMK	9.3	.318	0	0	81%	0%	0%
1-C	7.5	.256	0	0	63%	0%	0%
1-A	13.1	.449	1,186	486	102%	0%	11%
1-G	11.1	.380	733	667	68%	55%	50%
1-H	12.4	.424	733	667	68%	55%	72%
1-D	1.0	.034	0	0	53%	0%	8%
1-E	17.4	.595	733	667	100%	55%	91%

ALT	Sawtimber Jobs/Income	Waferwood Jobs/Income	Decade 1 Timber Break-even Price
	# JOBS/MM 82$	**RISK OF LOSING-(RANKED)**	**1982 $/MBF**
BMK	291/3.2	6 - High	54.0
1-C	227/2.5	6	54.2
1-A	366/4.0	4	52.2
1-G	243/2.7	3 - Moderate	44.1
1-H	243/2.7	2	43.7
1-D	191/2.1	5	53.0
1-E	359/4.0	1 - Low	46.4

Alternative 1C Compared to Benchmark 3A

Neither Alternative 1C nor Benchmark 3A require new roads into sensitive roadless areas In the first decade Alternative 1C requires 4 fewer miles of new local road construction and 5 fewer miles of local road reconstruction each year than Benchmark 3A

Overall, Alternative 1C would supply less wood fiber than Benchmark 3A. Alternative 1C would provide 63% of expected sawtimber demand compared to the 83% of demand that would be provided by Benchmark 3A Both Benchmark 3A and Alternative 1C provide no POL.

Neither Benchmark 3A nor Alternative 1C would reduce the risk of insect and disease outbreaks on the Forest since neither harvests ponderosa pine or lodgepole pine

Alternative 1C would decrease sawtimber jobs and income by 64 jobs and $700,000 in annual employee income when compared to Benchmark 3A Alternative 1C would provide for 86 fewer jobs and a decrease of $1,000,000 in employee income when compared to the actual timber harvest levels of 1989 if the local sawtimber industry cannot find additional sources of logs.

Both Benchmark 3A and Alternative 1C provide no POL, and the risk of losing the local waferwood plant jobs and income (353 jobs and $5,900,000 in employee income) is high.

Net timber receipts in the first decade would increase by $160,000 annually for Alternative 1C when compared to Benchmark 3A This increase would be present because Benchmark 3A harvests more timber for water augmentation and this does not provide a cash return Over the first 50 years of the planning horizon, Alternative 1C would lose a total of $360,000 annually, or $320,000 less each year than Benchmark 3A

The timber break-even price for Alternative 1C is $54 20/MBF which is $ 20/MBF more than Benchmark 3A. The slightly higher price per MBF for Alternative 1C is due to the smaller harvest level of Alternative 1C harvest level which is needed to offset the $160,000 in fixed costs

Neither Benchmark 3A nor Alternative 1C logs aspen in the first decade although Benchmark 3A logs significant levels of aspen in the later decades and designates 79,100 more acres of suited aspen timber land than Alternative 1C.

In the first decade, Alternative 1C would contribute an 1,800 fewer acre feet of water each year than Benchmark 3A Water production decreases because Alternative 1C does not harvest as much timber as Benchmark 3A

The total timber Present Net Value (PNV) for Alternative 1C is $1,600,000 less than Benchmark 3A The decrease is due primarily to the decrease in water augmentation benefits in Alternative 1C. The Alternative 1C timber PNV is $7,600,000 greater than PNV in Benchmark 3A. The Alternative 1C water yield PNV is $9,200,000 less than PNV in Benchmark 3A

The following table shows the changes in the indicators of response for Alternative 1C compared to Benchmark 3A

ALTERNATIVE 1C COMPARED TO BENCHMARK 3A	Total	Change Increase	Change Decrease
Sensitive roadless areas developed in the first decade	0	No Change	
New local road construction/reconstruction in the first decade (miles/yr)	11/15		4/5
Sawtimber demand supplied (percent)	63%		18%
Conifer POL demand supplied (percent)	0%	No Change	
Aspen POL demand supplied (percent)	0%	No Change	
Area treated to reduce insect and disease infestation in the first decade (M acres/yr)	0%	No Change	
Sawtimber jobs/income per year	227/$2 5		64/$0 7
Risk of losing waferwood jobs and income	Very High	No Change	
Timber program first decade annual net receipts (MM 1982 Dollars/year)	$-0 58	$0 16	
Timber program 50 year average net revenue (MM 1982 Dollars/year)	$-0 36	$0 32	
Timber Break-even Price (1982 Dollars/MBF)	$54 2	$0 2	
Aspen classified as suited for timber production (M acres)	0 3		79 1
Aspen commercially harvested in decade one (M acres/yr)	0	No Change	
Increased water yield in the first decade (M acre ft /yr)	7 6		1 8
Timber PNV over planning horizon (MM 1982 Dollars)	$-11 3	$7 6	
Increased water yield benefits in the first decade (MM 1982 Dollars/year)	$0 26		$0 06
PNV of increased water yield benefits over the planning horizon (MM 1982 Dollars)	$12 5		$9 2
Total timber PNV (MM 1982 Dollars)	$1 2		$1 6

Alternative 1A Compared to Alternative 1C

Implementation of Alternative 1A would require entry into the Roubideau and Tabeguache sensitive roadless areas, two more than in Alternative 1C. In the first decade Alternative 1A would require 13 more miles of new local road construction and 10 more miles of road reconstruction each year than Alternative 1C.

Alternative 1A supplies more wood fiber than Alternative 1C. Alternative 1A slightly exceeds sawtimber demand, while Alternative 1C provides only 63% of demand Neither alternative supplies conifer POL Alternative 1A supplies 11% of aspen waferwood demand in the first decade, while Alternative 1C does not. Alternative 1A would provide an 81% increase in woodfiber over Alternative 1C in decade one.

Alternative 1A would reduce the risk of insect and disease outbreaks on 17,000 acres of the Forest in decade one. This reduction would come from timber harvests in lodgepole and ponderosa pine Alternative 1C does not harvest lodgepole or ponderosa pine in decade one

Alternative 1A would increase sawtimber jobs and income by 139 jobs and $1,500,000 in annual employee income compared to Alternative 1C Alternative 1A would provide for 53 more jobs than Alternative 1C and an increase of $500,000 in employee income compared to the actual 1989 timber harvest levels if the local sawtimber industry used the entire 31.5 MMBF of sawtimber provided by Alternative 1A

Alternative 1A provides for 11% of waferwood demand; for this Alternative the risk of losing the local waferwood plant jobs and income (353 jobs and $5,900,000 in employee income) is the third highest of the Alternatives. Alternative 1C poses the highest risk

The Alternative 1A timber program is less financially efficient than Alternative 1C program. Net timber receipts in the first decade would decrease by $560,000 each year compared to Alternative 1C. This decrease in net timber receipts is due to the larger timber program in Alternative 1A. Over the first 50 years of the planning horizon, Alternative 1A would lose a total of $700,000 each year, or $330,000 more annually than Alternative 1C.

The timber break-even price for Alternative 1A is $52 20/MBF which is $2 00/MBF less than Alternative 1C. The lower price per MBF for Alternative 1A is due to the larger Alternative 1A harvest level which offsets $160,000 in fixed costs.

Alternative 1A would require 25,700 more aspen acres in the suited land base than Alternative 1C since Alternative 1A harvests aspen continuously over the 150 year planning horizon and Alternative 1C does not harvest aspen until decade 9 In the first decade, Alternative 1A would clearcut an additional 310 acres of aspen each year.

In the first decade, Alternative 1A would contribute an additional 13,100 acre feet of water each year. The increase is 5,600 acre feet a year more than Alternative 1C Economic benefits from increased water production are also higher under Alternative 1A The increase in water production is due to the increase in timber harvesting.

The total timber Present Net Value (PNV) for Alternative 1A is $4,500,000 less than Alternative 1C. The decrease is due primarily to increased timber costs that outweigh the expected benefits. Over the planning horizon of 150 years, the timber PNV for the Alternative 1A timber program is $9,200,000 less than the timber PNF for Alternative 1C The Alternative 1A increased water yield PNV is $4,700,000 more than Alternative 1C. This partially offsets the financial losses from timber management.

The following table shows the changes in the indicators of response for Alternative 1A when compared to Alternative 1C .

ALTERNATIVE 1A COMPARED TO ALTERNATIVE 1C	Total	Change Increase	Change Decrease
Sensitive unroaded areas developed in the first decade	2	2	
New local road construction/reconstruction in the first decade (miles/yr)	24/25	13/10	
Sawtimber demand supplied (percent)	102%	39%	
Conifer POL demand supplied (percent)	0	No Change	
Aspen POL demand supplied (percent)	11%	11%Change	
Area treated to reduce insect and disease infestation in the first decade (M acres/yr)	1 7	1 7	
Sawtimber jobs/income per year	366/$4 0	139/$1 5	
Risk of losing waferwood jobs and income	High		Lower Risk
Timber program first decade annual net receipts (MM 1982 Dollars/year)	$-1 14		$0 56
Timber program 50 year average net revenue (MM 1982 Dollars/year)	$-0 70		$0 33
Timber Break-even Price (1982 Dollars/MBF)	$52 2		$2 0
Aspen classified as suited for timber production (M acres)	26 0	25 7	
Aspen commercially harvested in decade one (M acres/yr)	0 31	31	
Increased water yield in the first decade (M acre ft /yr)	13 1	5 6	
Timber PNV over planning horizon (MM 1982 Dollars)	$-20 6		$9 2
Increased water yield benefits in the first decade (MM 1982 Dollars/year)	$0 4		$0 2
PNV of increased water yield benefits over the planning horizon (MM 1982 Dollars)	$17 3	$4 7	
Total timber PNV (MM 1982 Dollars)	$-3 3		$4 5

Alternative 1G Compared to Alternative 1A

Implementation of Alternative 1G would not require entry into the Roubideau and Tabeguache sensitive roadless areas, unlike Alternative 1A which enters both Alternative 1G was designed to avoid timber harvesting in sensitive areas; Alternative 1A was not. Alternative 1G would require the same number of local road construction miles and 2 fewer miles annually of local road reconstruction than Alternative 1A in the first decade

Overall, Alternative 1G would supply a higher level of wood fiber than Alternative 1A Alternative 1G would provide for 68% of the estimated sawtimber demand, 55% of conifer POL demand and 50% of aspen POL demand This is 34% less sawtimber, 55% more conifer POL and 39% more aspen POL than Alternative 1A Alternative 1G provides for a timber sale program which is 11% (3,480 MMBF) higher than Alternative 1A in decade one

Alternative 1G would reduce the risk of insect and disease outbreaks on 272 fewer acres each year in decade one than Alternative 1A This reduction would be accomplished through timber harvests in lodgepole and ponderosa pine

Alternative 1G would decrease sawtimber jobs & income by 123 jobs and $1,300,000 in annual employee income compared to Alternative 1A Alternative 1G would provide for 70 fewer jobs and a decrease of $800,000 in employee income compared to actual timber harvest levels in 1989 if the local sawtimber industry cannot find an alternate source of logs.

Alternative 1G provides for 50% of waferwood demand The risk of losing the local waferwood plant jobs and income (353 jobs and $5,900,000 in employee income) is the third lowest among the Alternatives, while Alternative 1A has the second highest risk

Alternative 1G provides a timber sale program with greater financial efficiency than Alternative 1A Net receipts in the first decade would increase by $100,000 annually compared to Alternative 1A. The increase in financial efficiency is due to concentrating the slightly larger Alternative 1G timber sale program on more financially efficient timber stands Over the first 50 years of the planning horizon, the Alternative 1G net timber receipts would be -$835,000 annually, or $140,000 less than the loss in Alternative 1A

The timber break-even price for Alternative 1G is $44 10/MBF This is $8.10/MBF less than Alternative 1A. The lower price per MBF for Alternative 1G is due to the design of Alternative 1G While Alternative 1A harvests timber in the more expensive and less productive timber lands on the Forest, Alternative 1G is limited to the best timber lands on the Forest.

Alternative 1G requires 143,346 more aspen acres in the suited land base than Alternative 1A since Alternative 1G harvests significantly more aspen POL than Alternative 1A *In the first decade, Alternative 1G would clearcut 1,066 more* aspen acres each year than Alternative 1A.

In the first decade, Alternative 1G would contribute an additional 11,100 acre feet of water each year This increase is 2,000 acre feet a year less than the increase with Alternative 1A. Economic benefits from the increased water production are also lower under Alternative 1G. The decrease in water production is due to the decrease in the amount of spruce-fir and lodgepole pine harvesting in Alternative 1G compared to Alternative 1A.

The total timber Present Net Value (PNV) for Alternative 1G is $3,287,000 less than PNV for Alternative 1A The decrease is due mainly to a larger aspen program and a decrease in water augmentation in Alternative 1G compared to Alternative 1A. The timber PNV for Alternative 1G is $2,300,000 less than timber PNV for Alternative 1A The change in water augmentation PNV for Alternative 1G is $977,000 less than Alternative 1A.

The following table shows the changes in indicators of response for Alternative 1G compared to Alternative 1A.

ALTERNATIVE 1G COMPARED TO ALTERNATIVE 1A	Total	Change Increase	Change Decrease
Sensitive roadless areas developed in the first decade	0		2
New local road construction/reconstruction in the first decade (miles/yr)	24/23		0/2
Sawtimber demand supplied(percent)	68%		34%
Conifer POL demand supplied (percent)	55%	55%	
Aspen POL demand supplied(percent)	50%	39%	
Area treated to reduce insect and disease infestation in the first decade (M acres/yr)	1 4		0 3
Sawtimber jobs/income per year	243/$2 7		123/$1 3
Risk of losing waferwood jobs and income	Moderate		Lower Risk
Timber program first decade annual net receipts (MM 1982 Dollars/year)	$-1 04	$0 10	
Timber program 50 year average net revenue (MM 1982 Dollars/year)	$-0 84		$0 19
Timber Break-even Price (1982 Dollars/MBF)	$44 1		$8 1
Aspen classified as suited for timber production (M acres)	169 3	143 3	
Aspen commercially harvested in decade one (M acres/yr)	1 38	1 07	
Increased water yield in the first decade (M acre ft /yr)	11 1		2 0
Increased water yield benefits in the first decade (MM 1982 Dollars/year)	$0 38		$0 07
Timber PNV over planning horizon (MM 1982 Dollars)	$-22 9		$2 3
PNV of increased water yield benefits over the planning horizon (MM 1982 Dollars)	$16 2		$1 0
Total timber PNV (MM 1982 Dollars)	$-6 6		$3 3

Alternative 1H Compared to Alternative 1G

The only difference between Alternatives 1H and 1G is that Alternative 1H harvests 630 more acres of aspen each year from the more expensive and less productive aspen timber lands on the Forest.

Neither Alternative 1H nor Alternative 1G require entry into sensitive roadless areas in the first decade Alternative 1H does require 5 more miles of new local road construction and 3 more miles of local road reconstruction each year than Alternative 1G would require in the first decade

Alternative 1H supplies exactly the same amount of sawtimber and conifer POL as Alternative 1G However, Alternative 1H supplies 72% of aspen POL demand, or a 22% increase over Alternative 1G

Alternative 1H would provide for the same number of sawtimber jobs as Alternative 1G Alternative 1H has the second lowest risk of losing the local waferwood plant, while Alternative 1G has the third lowest risk

Alternative 1H would provide a timber sale program with less financial efficiency than Alternative 1G Annual first decade net timber receipts would be $113,000 less each year than those of Alternative 1G. The decrease in financial efficiency is due to the larger timber sale program of Alternative 1H Over the first 50 years of the planning horizon, the Alternative 1H timber sale program would lose $1,029,000 annually, or $194,000 more each year than Alternative 1G.

The timber break-even price for Alternative 1H is $43 70/MBF. This is $ 40/MBF less than Alternative 1G and is the lowest breakeven price of the Alternatives The slightly lower price per MBF for Alternative 1H is due to the larger Alternative 1H harvest level which offsets $160,000 in fixed costs

Alternative 1H requires that 71,800 more aspen acres be included in the suited land base to increase aspen harvesting by 630 acres each year over Alternative 1G. In the first decade, Alternative 1H would clearcut 630 more acres of aspen each year than Alternative 1G

In the first decade, Alternative 1H would contribute an additional 12,400 acre feet of water each year. The increase is 1,300 acre feet a year more than Alternative 1G would provide. Economic benefits from increased water production are also higher under Alternative 1H The increase in water production is due to the additional 630 acres of aspen harvested annually.

The total timber Present Net Value (PNV) for Alternative 1H is $3,900,000 less than Alternative 1G The loss of PNV is due mostly to additional aspen harvesting that would take place in more expensive timber lands on the Forest. The Timber PNV for Alternative 1H over the entire planning horizon of 150 years is $5,000,000 less than Alternative 1G The water augmentation PNV for Alternative 1H is, however, $1,150,000 more than Alternative 1G. The gain in water PNV for Alternative 1H over Alternative 1G is not enough to make up for the negative PNV of the timber program.

The following table shows the changes in the indicators of response for Alternative 1H compared to Alternative 1G

ALTERNATIVE 1H COMPARED TO ALTERNATIVE 1G	Total	Change Increase	Change Decrease
Sensitive roadless areas developed in the first decade	0	No Change	
New local road construction/reconstruction in the first decade (miles/yr)	29/26	5/3	
Sawtimber demand supplied (percent)	68%	No Change	
Conifer POL demand supplied (percent)	55%	No Change	
Aspen POL demand supplied (percent)	72%	22%	
Area treated to reduce insect and disease infestation in the first decade (M acres/yr)	1 4	No Change	
Sawtimber jobs/income per year	243/$2 7	No Change	
Risk of losing waferwood jobs and income	Low		Lower Risk
Timber program first decade annual net receipts (MM 1982 Dollars/year)	$-1 25		$0 11
Timber program 50 year average net revenue (MM 1982 Dollars/year)	$-1 03		$0 19
Timber Break-even Price (1982 Dollars/MBF)	$43 7		$0 4
Aspen classified as suited for timber production (M acres)	241 2	71 8	
Aspen commercially harvested in decade one (M acres/yr)	2 01	0 63	
Increased water yield in the first decade (M acre ft/yr)	12 4	1 3	
Timber PNV over planning horizon (MM 1982 Dollars)	$-27 9		$5 0
Increased water yield benefits in the first decade (MM 1982 Dollars/year)	$0 42	$0 04	
PNV of increased water yield benefits over the planning horizon (MM 1982 Dollars)	$17 4	$1 1	
Total timber PNV (MM 1982 Dollars)	$-10 1		$3 9

Alternative 1D Compared to Alternative 1H

Neither Alternative 1D nor Alternative 1H require entry into sensitive roadless areas in the first decade. Alternative 1D requires 20 fewer miles of new local road construction and 16 fewer miles of road reconstruction each year than Alternative 1H would require in the first decade.

Overall, Alternative 1D would supply a significantly lower level of wood fiber than Alternative 1H. Alternative 1D would provide for 53% of expected future sawtimber demand, 0% of expected future conifer POL demand, and 8% of expected future aspen POL demand in decade one Alternative 1D would provide for a timber sale program which is 59% (26,900 MBF) smaller than Alternative 1H in decade one.

Alternative 1D would not reduce the risk of insect and disease outbreaks because it does not harvest lodgepole pine or ponderosa pine in the first decade Alternative 1H harvests 773 acres of lodgepole pine and 667 acres of ponderosa pine each year in the first decade.

Alternative 1D would decrease sawtimber jobs and income by 52 jobs and $600,000 each year in employee income when compared to Alternative 1H. Alternative 1D would provide for 122 fewer jobs and a decrease of $1,400,000 each year in employee income when compared to 1989 actual timber harvest levels if the local sawtimber industry cannot find an additional source of logs

Alternative 1D provides for 8% of waferwood demand and the risk of losing the local waferwood plant jobs and income (353 jobs and $5,900,000 in employee income) is the second highest among the Alternatives. Alternative 1H poses the second lowest risk

Alternative 1D would provide a timber sale program of significantly higher timber financial efficiency than Alternative 1H. Alternative 1D net timber receipts in the first decade would be -$600,000 each year, a loss of $660,000 less each year than Alternative 1H. The increase in financial efficiency is due to the decrease in timber production compared to Alternative 1H Over the first 50 years of the planning horizon, the Alternative 1D timber sale program would lose $550,000 annually, or $480,000 less each year than Alternative 1H

The timber break-even price for Alternative 1D is $53.00/MBF This is $9 30/MBF more than Alternative 1H. The higher Alternative 1D price is due to the smaller harvest level needed to finance $160,000 in fixed costs and the high costs of selection harvesting.

Alternative 1D requires 204,420 fewer suited aspen acres than Alternative 1H, due to Alternative 1D's significantly smaller aspen timber program. In the first decade, Alternative 1D clearcut 1,520 fewer aspen acres each year than Alternative 1H

In decade one, Alternative 1D contributes an additional 1,000 acre feet of water each year. This increase is 11,400 acre feet a year less than Alternative 1H The Alternative 1D water production economic benefits are $390,000 less per year than those of Alternative 1H in decade one, and $16,400,000 less over the entire 150 year planning horizon. The lower Alternative 1D water production results from the extensive selection timber harvesting done in Alternative 1D. Selection harvesting does not produce a water yield

The total timber Present Net Value (PNV) for Alternative 1D is $2,274,000 less than the PNV Alternative 1H. The decrease is due mainly to smaller water benefits in Alternative 1D. The Alternative 1D timber PNV timber program is $14,200,000 greater than Alternative 1H This large change is due to Alternative 1D's significantly smaller timber program. The Alternative 1D water PNV is $16,500,000 less than Alternative 1H and more than offsets the gain in timber PNV

The following table shows the changes in the indicators of response for Alternative 1D compared to Alternative 1H

ALTERNATIVE 1D COMPARED TO ALTERNATIVE 1H	Total	Change Increase	Change Decrease
Sensitive roadless areas developed in the first decade	0	No Change	
New local road construction/reconstruction in the first decade (miles/yr)	9/10		20/16
Sawtimber demand supplied (percent)	53%		15%
Conifer POL demand supplied (percent)	0		55%
Aspen POL demand supplied (percent)	8%		64%
Area treated to reduce insect and disease infestation in the first decade (M acres/yr)	0		1,400
Sawtimber jobs/income per year	191/$2 1		52/$0 6
Risk of losing waferwood jobs and income	High	Increase in Risk	
Timber program first decade annual net receipts (MM 1982 Dollars/year)	$-0 60	$0 66	
Timber program 50 year average net revenue (MM 1982 Dollars/year)	$-0 55	$0 48	
Timber Break-even Price (1982 Dollars/MBF)	$53 0	$9 3	
Aspen classified as suited for timber production (M acres)	36 7		204 4
Aspen commercially harvested in decade one (M acres/yr)	0 49		1 52
Increased water yield in the first decade (M acre ft /yr)	1.0		11 4
Timber PNV over planning horizon (MM 1982 Dollars)	$-13 7	$14 2	
Increased water yield benefits in the first decade (MM 1982 Dollars/year)	$0 03		$0 39
PNV of increased water yield benefits over the planning horizon (MM 1982 Dollars)	$ 1.0		$16 5
Total timber PNV (MM 1982 Dollars)	$-12 7		$2 3

Alternative 1E Compared to Alternative 1D

Although Alternative 1E and Alternative 1D are the two alternatives with the lowest PNVs, they are very different Alternative 1E has the highest timber harvest level among the alternatives while Alternative 1D has the lowest Alternative 1E has the largest timber budget but Alternative 1D has the lowest. These two alternatives have similar PNVs for different reasons. Alternative 1E harvests a great deal of timber at a high cost. Some of the Alternative 1E costs are offset by water benefits, but water benefits are not enough to give this alternative a high PNV Alternative 1D has a very low level of water augmentation and as a result has low water benefit values Even though Alternative 1D has the second most efficient timber program among the alternatives, the lack of water benefit values results in a relatively low PNV.

Implementation of Alternative 1E requires entry into both the Roubideau and Tabeguache sensitive roadless areas, while Alternative 1D enters neither in the first decade. Alternative 1E requires 32 more miles of new local road construction and 29 more miles of local road reconstruction each year than Alternative 1D in the first decade.

Overall, Alternative 1E supplies the greatest level of timber among the alternatives, while Alternative 1D supplies the lowest level. Alternative 1E would provide for 100% of expected future sawtimber demand, 55% of expected future conifer POL demand, and 91% of expected future aspen POL demand in decade one. Alternative 1E provides for a timber sale program which is 225% (42,600 MBF) larger than Alternative 1D in decade one

Alternative 1E would reduce the risk of insect and disease outbreaks on 1,400 more acres in decade one than Alternative 1D which does not harvest any lodgepole pine or ponderosa pine.

Alternative 1E would increase sawtimber jobs and income by 168 jobs and $1,900,000 in employee income each year when compared to Alternative 1D Alternative 1E provides for 46 more jobs and an increase of $500,000 in employee income when compared to 1989 actual timber harvest levels in 1989 providing that the local sawtimber industry can sustain the Alternative 1E sawtimber harvest level

Alternative 1E provides the highest level of aspen POL and has the lowest risk of losing local waferwood plant jobs and income (353 jobs and $5,900,000 in employee income), while Alternative 1D has the second highest risk

Alternative 1E would provide a timber sale program with lower timber financial efficiency than Alternative 1D Alternative 1E net timber receipts in the first decade would be -$1,820,000 each year, a decrease of $1,220,000 per year compared to Alternative 1D The decrease in financial efficiency is due to the significantly larger Alternative 1E timber program. Over the first 50 years of the planning horizon, the Alternative 1E timber sale program would lose $1,570,000 each year, or $1,020,000 more annually than Alternative 1D

The timber break-even price for Alternative 1E is $46 40/MBF This is $6 60/MBF less than Alternative 1D The lower price per MBF for Alternative 1E is a result of the larger Alternative 1E harvest level which offsets $160,000 in fixed costs, despite extensive harvesting in the more costly and less productive timber lands on the Forest

Alternative 1E would require 248,000 more aspen acres in the suited land base than Alternative 1D because Alternative 1E harvests significantly more aspen. In the first decade, Alternative 1E would clearcut 2,300 more acres of aspen each year than Alternative 1D

In the first decade, Alternative 1E would contribute an additional 17,400 acre feet of water each year This increase is 16,400 acre feet a year more in decade one than Alternative 1D would provide Economic benefits fromincreased water production in Alternative 1E are $560,000 more per year than those of Alternative 1D in decade one, and $25,500,000 more over the 150 year planning horizon Alternative 1D has a lower average timber harvest and the spruce-fir timber harvesting planned in Alternative 1D does not provide a water yield.

The total timber Present Net Value (PNV) for Alternative 1E is $2,370,000 less than that of Alternative 1D The decrease is due to the large Alternative 1E timber program which has greater costs than receipts. The direct timber Alternative 1E PNV is $27,980,000 less than the timber PNV in Alternative 1D as a result of the large Alternative 1E timber program The Alternative 1E water PNV is $25,300,000 more than Alternative 1D due to Alternative 1E's large timber program and the small water benefit obtained from Alternative 1D

The following table shows the changes in the indicators of response for Alternative 1E compared to Alternative 1D.

ALTERNATIVE 1E COMPARED TO ALTERNATIVE 1D	Total	Change Increase	Change Decrease
Sensitive roadless areas developed in the first decade	2	2	
New local road construction/reconstruction in the first decade (miles/yr)	41/39		32/29
Sawtimber demand supplied (percent)	100%	47%	
Conifer POL demand supplied (percent)	55%	55%	
Aspen POL demand supplied (percent)	91%	83%	
Area treated to reduce insect and disease infestation in the first decade (M acres/yr)	1 4	1 4	
Sawtimber jobs/income per year	359/$4 0	168/$1 9	
Risk of losing waferwood jobs and income	Very Low	Decrease in risk	
Timber program first decade annual net receipts (MM 1982 Dollars/year)	$-1 82		$1 22
Timber program 50 year average net revenue (MM 1982 Dollars/year)	$-1 57		$1 02
Timber Break-even Price (1982 Dollars/MBF)	$46 4		$6 6
Aspen classified as suited for timber production (M acres)	284 5	247 8	
Aspen commercially harvested in decade one (M acres/yr)	2 80	2 30	
Increased water yield in the first decade (M acre ft /yr)	17 4	16 4	
Increased water yield benefits in the first decade (MM 1982 Dollars/year)	$0 60	$0 56	
Timber PNV over planning horizon (MM 1982 Dollars)	$-41 6		$28 0
PNV of increased water yield benefits over the planning horizon (MM 1982 Dollars)	$26 5	$25 5	
Total timber PNV (MM 1982 Dollars)	$-15 1		$2 4

III. Affected Environment

III. AFFECTED ENVIRONMENT

TABLE OF CONTENTS

Pages

FIGURES

TABLES

CHAPTER III

AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the physical, biological, social, and economic aspects of the Forest's environment, and includes information that was not available when the FEIS was published The information presented here supplements the 1983 Forest Plan EIS *This Supplemental EIS is intended to address the issues raised* by the USDA Appeal Decision, signed July 31, 1985 by Assistant Secretary Douglas MacCleery, and to provide a basis for the analysis of an aspen harvest program needed to meet the demand created by the newly located waferboard plant at Olathe

The Affected Environment section of an EIS is intended to describe the environment of the area that may be affected by the alternatives under consideration The descriptions should be no longer than needed to understand the effects of the alternatives as they are presented later in the EIS (in Chapter IV of this EIS) This section sets the stage for the reader so that he or she will be able to compare the existing situation with the anticipated effects of various alternatives. One technique the reader might employ to help understand the effects of the Alternatives would be to first read a section from Chapter III and then to turn to the corresponding section in Chapter IV to consider the consequences of the Alternatives in terms of that resource or issue area An important part of the "existing situation" is the demand analysis for resources.

Change in the economic demand for the resource outputs produced by the Forest was one point raised by the 1985 USDA Decision In the Decision letter, the Secretary raised the questions.

"Are the non-timber multiple use benefits to be achieved through the timber program really needed? Do projections of demand for these non-timber objectives support the need for the Federal expenditures required to achieve them?" (1985 USDA Decision, p. 9)

In response, the Forest evaluated changes in resource demand which have occurred since the original resource demand projections were developed in 1980

In general, the analysis establishes that there exists very little opportunity exists to meet multiple-use objectives through the commercial timber sale program. Demands for livestock forage, wildlife habitat, developed recreation, and dispersed recreation can be met without additional multiple-use benefits *produced by the commercial timber sale program. However, the demand for* water produced by the Forest is expected to exceed the supply by a significant amount

This section supplements pages III-2 through III-10 of the 1983 FEIS. The MacCleery Decision required the Forest to present the analysis concerning the purpose of vegetation management

Purposes of Vegetative Management

Forest vegetation is treated for a variety of purposes. The most important purpose is to provide the mix of goods and services desired by the public Depending on environmental conditions and differing goals and objectives, there are many possible reasons for treating forest vegetation. The benefits that can result from treating Forest vegetation are:

- increased dispersed recreation resulting from cleared areas and additional roads
- increased opportunities for dispersed motorized recreation resulting from additional roads
- improved and safer developed recreation sites
- creation and maintenance of scenic vistas resulting from cleared areas
- improved long term visual quality resulting from cleared areas
- increased water yields resulting from removal of vegetation
- improved range conditions and better livestock access to suitable forage and/or water resulting from vegetation removal
- a stable, or increasing, number of jobs and income related to forest activities
- a stable community social structure resulting from an increased number of jobs from forest-related activities
- improved habitat capability for elk, deer, and bighorn sheep, timber sales can improve the quality of the habitat by increasing both diversity and distribution of species.
- improved bighorn sheep migration routes (patterns) between summer and winter ranges through the creation of additional roads
- increased and improved wildlife habitat diversity (vertical and horizontal) for indicator species
- reduced risk of loss from wildfires
- conditions more favorable to suppression of wildfires (as a result of additional roads)
- conditions more favorable to halting outbreaks of insect and disease infestations as a result of removing diseased or infested trees

The major reasons for vegetation treatment on commercial forest land on the Forest are: commercial sales to meet the wood fiber demand, prevention of future expenditures of federal funds to combat insect and disease outbreaks in lodgepole pine and ponderosa pine, maintenance of the aspen type in conifer-invaded stands. An important reason to meet wood fiber demand is the maintenance of jobs and income from the timber industry in surrounding communities Other benefits include water augmentation, some minor forage increases on big game winter range and minor amounts of forage increases for domestic livestock.

Cost Reduction/Revenue Enhancement

During the years since the original Forest Plan was published, the costs associated with timber management have been reduced and actions to increase revenues from the commercial timber program have been established. Some of the more significant actions include:

- The Forest has raised the standard rate for Products Other than Logs (POL) from $1.30 per ton to $1 90 per ton (a 31% increase), and the Region has raised the standard rates for other forest products.

- Below cost timber sales and methods to either lower costs or raise revenues were examined by the Regional Office in 1984 and 1985

- A Forest committee conducted a timber cost study in 1985. This committee made recommendations to the Forest Supervisor. As a result, actions for reducing costs have been taken. The primary step to reduce cost was the zoning of district timber positions Four Ranger Districts have been combined to form two separate zones. This has reduced timber-related costs

- Issuance of a Region 2 policy on economic analysis (R-2 Supp. No. 8, FSM 1970.6 in March, 1986 and R-2 Supp. No. 12, FSM 1970.3 in April, 1988). This policy was intended to achieve the land management objectives established in the Forest Plan in the most cost efficient manner by narrowing the gap between costs and revenues. The result has been a reduction in timber related costs.

- Establishing the practice of conducting an economic analysis to determine the relative economic viability of timber sales prior to placing a timber sale on the Five Year Timber Sale Action Plan A more detailed analysis is done as part of the environmental analysis process after alternatives are more clearly defined

- The Region has changed timber utilization standards. This has resulted in decreased skid, haul, and manufacturing costs The end result is greater revenues

- The Region has developed an automated timber sale appraisal system to reduce sale preparation costs.

- The Forest has reduced road standards and the amount of engineering design work required for logging roads in order to lower costs.

- The Forest has adopted the use of HP-71B hand-held computers for log scaling. This has reduced clerical costs. The Forest is also using the HP-71B's for cruising timber.

- The Forest has initiated weight scaling for aspen products for sales larger than 50 acres and is selling the sales by estimated tonnage. This reduces sale preparation costs and post-sale measurement costs as well as allowing for increased accuracy in determining the volume removed from sales

- The Amended Plan's Standards and Guidelines will provide directions for preparing timber sales that emphasize efficiency. A special emphasis will be placed on aspen sales. The direction will be to treat entire clones in one entry as apposed to past practices of using many small treatment units.

The costs and revenues used in the analysis reflect these changes All of the alternatives were developed and analyzed using this information.

RESOURCE ELEMENTS

BIOLOGICAL DIVERSITY

"Diversity" is "the distribution and abundance of different plant and animal communities and species within a [specified area]." (36 CFR 219 3). Diversity, as defined in the National Forest Management Act, has evolved as a concept and is now known as "Biological Diversity " The biological diversity of forest vegetation is important because increased diversity provides an increasing number of habitat niches This, in turn, can provide greater wildlife species This also contributes to the stability of wildlife and vegetative communities. Stability is the ability of a community to withstand catastrophe (Margalef 1969) or to return to its original state after severe alteration (Odum 1971).

The Forest has been given the task of managing the land for biological diversity while maintaining the multiple-use objectives of the Forest Plan (36 CFR 219.25)

Biological diversity includes several biological components. Genetic Diversity, Species Diversity, and Community Diversity. (Draft Biological Diversity Assessment, Rocky Mountain Region USDA Forest Service 11/90; page 3).

Each of these components is discussed in both this section and the Environmental Consequences section of Chapter IV. Diversity is also discussed in sections on vegetation and wildlife since it is important in the assessment of those resources

Genetic Diversity

Genetic diversity describes the ability to maintain natural genetic diversity in a population of plants and animals, and the ability to maintain a barrier free environment which promotes the reproductive exchange of individual species members from different geographic areas. Maintaining genetic diversity demands that management practices which simplify the genetic make-up of a population of plants or animals be avoided.

Timber management can simplify genetic diversity when trees are planted after timber harvesting instead of relying on natural regeneration (a process of designing a timber sale to reseed itself after harvest) Planted trees can be either clones of a single tree or seeds from a selected few superior trees. Either choice simplifies the genetic diversity of a timber stand Since many different stands are harvested and planted over a period of time, genetic diversity can be simplified on a large scale Natural regeneration maintains a higher level of genetic diversity in the ecosystem, and thereby reduces the potential for populations to decline as a result of poor genetic variability. The Plan Amendment uses natural regeneration as a standard reforestation tool and uses planting as an option only when natural regeneration fails to work (See Forest Plan Amendment pages III-46-49).

Clearcutting aspen does not affect genetic diversity. Aspen regenerates by sprouting and maintains the same genetic make-up before and after harvest.

Very little timber harvesting has occurred in riparian areas and wetlands of the Forest in the past and timber harvesting is not expected to affect the genetic, species, or community diversity of riparian areas, wetlands, streams, or lakes on a large scale.

Many riparian areas, wetlands, streams, and lakes have, however, experienced a reduction in diversity due to domestic livestock grazing.

Species Diversity

Species diversity describes the ability to maintain a diversity of plant and animal species. Based on multiple-use objectives, species diversity may call for reintroducing plant and animal species which have been eliminated from the Forest or reduced in abundance.

Timber management can reduce species diversity when it favors one tree species over another or when other activities, such as fire suppression, reduce the naturally occurring abundance of a species. Spruce-fir timber harvesting practices usually favor Englemann spruce over subalpine fir, thereby reducing the abundance of subalpine fir on the Forest Timber harvesting in other timber species does not generally favor one species over another. Fire suppression, however, has reduced aspen on the Forest below naturally occurring levels as conifer trees take over aspen sites Harvesting mixed aspen/conifer stands can favor aspen regrowth and delay conifer invasion.

Timber harvesting can affect wildlife species diversity in either a positive or negative way. When any mature or old growth stand of timber is cut --- whether it be aspen, spruce-fir, ponderosa pine, lodgepole pine or Douglas fir --- one important element of wildlife diversity can be adversely affected The primary cavity nesters, including a number of species of woodpeckers, are dependent on larger trees for cavity excavation. Secondary cavity nesters including the mountain bluebird, swifts, swallows, wrens, owls, and chickadees, nest in cavities previously made by woodpeckers. Clearcutting is most detrimental to cavity nesters but selective logging can also be damaging if provisions are not made to leave trees with cavities standing to leave some trees which are easily excavated by primary cavity nesters. Species which are dependent on dead and down wood can also suffer unless this material is provided for nesting and foraging habitat. When harvests are made in blocks of single-aged stands throughout a large area or watershed, different communities are created and wildlife species diversity increases over the watershed or area involved However, wildlife species diversity will generally decrease within the immediate cutting unit boundary. Species diversity tends to decrease because an even-aged stand is generally created as a result of logging, and this provides habitat to a narrow range of plant and animal species. Generally the forest stand to be cut contains multi-layers of forest canopies which provide habitats for a wide range of species. Many large blocks of mature, even-aged stands of lodgepole pine exist on the Forest Timber harvesting will increase species diversity within the overall area affected by the harvesting.

Mature aspen stands have a high level of species diversity (Draft Biological Diversity Analysis, USDA Forest Service Rocky Mountain Region 11/90, page 13) Timber harvests of aspen will reduce short-term species diversity but may increase long-term species diversity. Many aspen stands are now being invaded by conifer trees (roughly 25%). These aspen stands will eventually be completely taken over by the conifers, unless fire or other natural occurrences remove the conifer understory. A conifer-invaded aspen stand has a greater species diversity than either a mixed stand or a pure aspen stand, but the final pure conifer stand will have less diversity than either a mixed stand or a pure aspen stand. Clearcutting a conifer-invaded aspen stand will decrease present species diversity in return for the greater overall diversity of the pure aspen stand after it reaches maturity.

Old growth in ponderosa pine is rare due to a combination of past logging and mountain pine beetle epidemics. Additional harvests of ponderosa pine may eliminate wildlife species dependent on ponderosa pine old growth and decrease species diversity although a properly planned ponderosa pine timber sale may reduce the vulnerability of a stand to mountain pine beetle attack A mountain pine beetle attack on an untreated stand may kill more trees than a timber harvest would and species diversity would be lower than if a timber sale had occurred.

Community Diversity

Community diversity describes the ability to maintain different plant and animal communities at natural levels Community diversity calls for protecting, restoring, or enhancing rare, unique, endemic, or rapidly declining plant and animal communities

Timber management can greatly reduce community diversity when it harvests old growth to the point that little remains. Conversely, management can enhance community diversity when timber harvesting creates young stands in otherwise large blocks of old growth Old growth ponderosa pine communities is rare on the Forest, compared to other tree species. Old growth ponderosa pine has generally been logged or killed by mountain pine beetles

Timber harvesting can reduce community diversity by cutting trees in unique ecosystems to the extent that the ecosystem no longer exists. Some unique ecosystems are currently protected by "10A" research natural area and "10C" special interest management prescriptions which do not allow timber harvesting.

FOREST VEGETATION

This section supplements pages III-85 through III-94 of the 1983 FEIS A forest is an extensive plant community of predominantly tree and shrub species, in all stages of growth and decay, with the quality of self-perpetuation or development into a stage of ecological climax

The diversity of forest tree vegetation and the associated overall biological diversity are primary concerns in the analysis of the effects of alternatives. The concept of biodiversity has evolved since 1983 and is discussed in a new section ("Biodiversity") in this chapter. Biodiversity was not addressed in the 1983 FEIS.

Table III-3 "Land Tentatively Suited for Timber Production," under the "Timber" section of this chapter provides a summary of tree vegetation by species on the Forest.

Forest Condition - Aspen

Aspen forests have been "managed" for more than 100 years on the Grand Mesa, Uncompahgre and Gunnison National Forests. Human management of the forests has influenced the vertical diversity of these stands Most aspen stands are naturally "even-aged" and so naturally lack vertical diversity. Self-regenerating aspen stands generally exhibit some vertical diversity; however, this is limited by the number of age classes within the stand. Some stands have many age classes while other stands have only one. Conifer-invaded aspen stands contain the highest degree of vertical diversity of these three structural types. Table III-1 indicates the Forest's vertical diversity within the aspen type

TABLE III-1 - **VERTICAL DIVERSITY WITHIN ASPEN TYPE**

Aspen Type	Vertical Diversity	*Approximate Acres
Even-aged	Least	176,341
Conifer Invaded	Most	93,431
Self-Regenerating	Some	76,012
TOTAL		345,784

* This includes aspen within the tentatively suited land base.

Horizontal diversity within the aspen type has also been affected During the past 70-100 years most of the aspen stands on the Forest have reached maturity because they have been protected from wildfire and have not been logged for forest products. As a result the aspen stands have progressed into a more homogenous and less diverse vegetative mosaic than would occur naturally. This has resulted in a low degree of horizontal diversity. Table III-2 indicates the large percentage of aspen acres in the mid and late structural stages·

TABLE III-2 - **STRUCTURAL STAGE ASPEN TYPE**

Structural Stage Aspen Type	* Acres	%
Sawtimber	131,967	38
Poletimber	130,696	38
Seed/Sap	7,109	2
Self Regenerating	76,012	22
TOTAL	345,784	100

* This includes all aspen acres on the Forest, except wilderness for which no data is available.

Forest Condition - Conifer

Some areas on the Forest are managed to provide natural to near natural forest conditions. Vegetative treatment is prohibited on some of these areas and others stress resource values that are not compatible vegetative treatment. Other areas of the Forest emphasize resource values which may generate treatment activities. In areas where human-induced changes are kept to a minimum, natural to near natural conditions will continue on the Forest. These areas add to the Forest's structural and plant diversity as they slowly move toward climax forest conditions. Typical conditions for older forests will be found in the density, health, vigor, age distribution, and species composition (diversity) of the Forest The degree of horizontal and vertical diversity of an area varies according to both the vegetative type and the structural stage of the area. Naturally occurring spruce-fir stands exhibit high levels of vertical diversity while lodgepole pine presents low levels.

Diversity created by human activities results from a given kind of treatment Generally, clearcutting and shelterwood activities result in even-aged stands and selection activities result in uneven-aged stands.

Forest Condition - Mature and "Old-Growth" Timber Stands

Old-growth Forests are an important part of the ecosystem because they perpetuate the climax of natural processes. Old-growth forests are not characterized merely by the presence of old trees. A more important element is that they have achieved a delicate balance of biological forces that keep the soil, water, insects, mammals, birds, grasses, shrubs, and trees in a natural, perpetuating condition Many species of plants and animals are dependent to some degree on old-growth conditions for their survival, and some require large, undisturbed areas Conversely, many species thrive on disturbance and the presence of early successional forests --- those created by fire, insect epidemics, and logging Both young and old-growth forests are important components of a healthy forest-wide ecosystem.

Definition

Old-growth forests are ecosystems distinguished by mature trees and their related structural attributes. Old growth encompasses the late stages of stand development and typically differs from the early stages in such characteristics as tree size, accumulations of large pieces of dead, woody material, the number of canopy layers, species composition, and ecosystem function

Old growth is typically distinguished from younger growth by possessing several of the following attributes·

1. Large trees for the species or site
2. Wide variations in tree size or spacing
3. Higher accumulations of large dead, standing and fallen trees compared to earlier forest stages
4. Decadence in the form of broken or deformed tree tops or bole and root decay
5. Multiple canopy layers
6. Canopy gaps and understory patchiness

Rates of change in composition and structure of old growth forests are slow when compared to younger forests Different stages or classes of old growth will be recognizable in many forest types The structure and function of an old-growth ecosystem will also be influenced by its size, landscape position, and context

Sporadic, low to moderate severity disturbances are an integral part of old-growth forests. Canopy openings resulting from the death of overstory trees often give rise to patches of small trees, shrubs, and herbs in the understory.

Vegetation data

Currently, no extensive inventory has been conducted on the Forest to identify these old growth characteristics for particular timber stands. However, many of the biological characteristics are found in the older-aged trees for which data is available Although the age of a stand should not be used as a sole criteria for assessing the old growth potential of the Forest, age can provide a good indication. Figures IV-1 through IV-4 provide an indication of the number of acres in each timber type in the older age classes (91+ years) that currently exist on the Forest Although many stands older than 90 years may not provide the biological characteristics described above for old growth, the acreage figures can be used to show the Forests' potential to provide old growth habitat needs for certain wildlife species

TIMBER

CURRENT USE AND MANAGEMENT

The land base determined to be tentatively suited for timber production has been modified from the original Forest Plan due to the results of the new Forest Stage I Timber Inventory which was completed in 1987 Approximately 42% of the Forest (1,253,541 acres) is now classified as tentatively suited for timber production For the original (1983) Forest Plan, 1,089,208 acres were identified The differences are mainly due to the use of different definitions (for example, non-forest land no longer includes woodland types like pinyon-juniper and cottonwood) and the updated inventory The most striking change between the two determinations of tentatively suited lands is a significant decrease in the acres of "Forested Land Withdrawn From Timber Production." The original 1983 determination withdrew 848,337 acres as not meeting minimum biological growth standards of 20 cubic feet per acre per year The Amendment process did not use minimum biological growth standards, but instead used other methods to remove poor sites from timber production These methods included the determination of "Forest Land Incapable of Producing Industrial Wood," "Potential Resource Damage," and "Regeneration Difficulties." Figure III-1 and Table III-3 display the land tentatively suited for timber production. Appendix B, Section II, contains additional information concerning the new timber inventory.

FIGURE III-1

LAND TENTATIVELY SUITED FOR TIMBER PRODUCTION

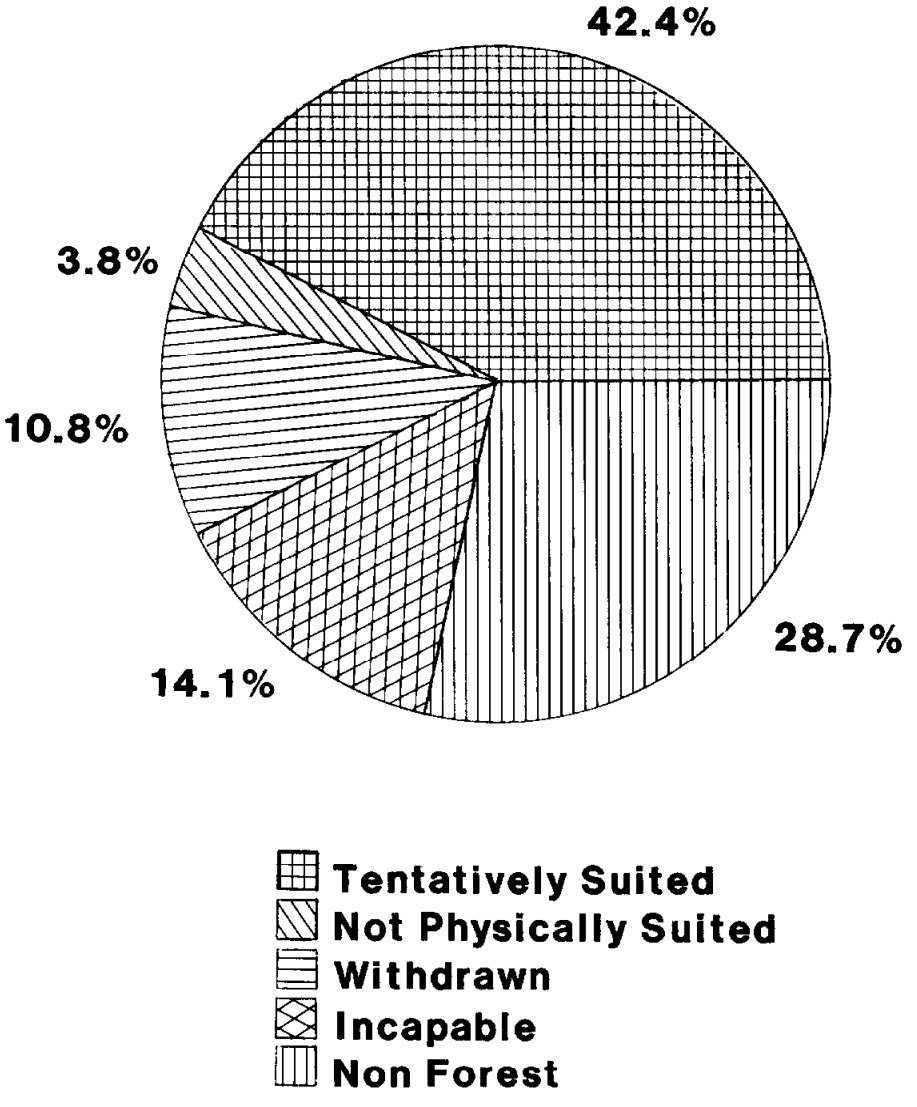


TABLE III-3 - LAND TENTATIVELY SUITED FOR TIMBER PRODUCTION

CRITERION	Non-Forest Water	Non-Forest Land	Oakbrush	Pinyon Juniper	Aspen Cottonwood	Lodgepole Pine	Ponderosa Pine	Spruce-Fir	Totals	1983 Plan
NON-FOREST LAND										
-Non-Forest		838,229							838,229	715,907
-Water	10,515								10,515	15,199
Subtotal									**848,744**	**731,106**
FOREST LAND WITHDRAWN FROM TIMBER PRODUCTION										
-Wilderness					49,629	32,475	151	186,661	269,116	213,249
-*Research Natural Areas*										
(1) Gothic										
(2) Escalante					32		205		237	
-Wilderness Study Area										
(1) Fossil Ridge					386	24,853		8,296	33,535	32,181
-*Further Planning Area*										
(1) Recommended portion of Cannibal Plateau					1,853	130		4,818	6,801	
-Minimum Biological Growth (less than 20 CF/AC/YR)										848,337
-Administrative Sites					10,043	50	165	1,219	2,477	1,298
-Campgrounds					781	3,166		3,525	7,472	
-Cultural Areas								400	400	
Subtotal					**53,924**	**60,674**	**521**	**204,919**	**320,038**	**1,095,491**
FOREST LAND INCAPABLE OF PRODUCING INDUSTRIAL WOOD			**167,606**	**112,097**	**58,226**	**4,384**	**10,256**	**65,044**	**417,613**	

TABLE III-3 - LAND TENTATIVELY SUITED FOR TIMBER PRODUCTION (continued)

CRITERION	Non-Forest Water	Non-Forest Land	Oakbrush	Pinyon Juniper	Aspen Cottonwood	Lodgepole Pine	Ponderosa Pine	Spruce-Fir	Totals	1983 Plan
NOT PHYSICALLY SUITED										
-Restocking within 5 years cannot be assured					328	108	355	8,126	8,917	
-Potential Resource Damage (plus 5A's)					71,485	2,077	1,309	27,712	102,582	37,381
-Inadequate Response Information					779		641	331	1,751	
Subtotal					**72,591**	**2,185**	**2,305**	**36,169**	**113,250**	**37,381**
UNSUITED TOTAL	10,515	838,229	167,606	112,097	184,741	67,243	13,082	306,132	1,699,645	1,863,978
TOTAL NET FOREST ACRES	10,515	838,229	167,606	112,097	530,526	317,119	114,700	862,394	2,953,186	2,953,186
LANDS TENTATIVELY SUITED FOR TIMBER PRODUCTION	**0**	**0**	**0**	**0**	**345,785**	**249,876**	**101,618**	**556,262**	**1,253,541**	**1,089,208**

SUITABILITY OF NATIONAL FOREST LANDS FOR TIMBER PRODUCTION

A timber suitability analysis was conducted on the Forest to determine its ability to produce timber on a sustained yield basis. The steps in the suitability analysis are:

1. Determination of lands tentatively suited for timber production.
2 Examination of the financial efficiency of tentatively suited timber lands
3 Examination of the economic efficiency of tentatively suited timber lands
4 Determination of lands suited for timber production.

Steps one through three are discussed here. Discussion of step four, the determination of lands suited for timber production, occurs in the Record of Decision (ROD)

DETERMINATION OF TENTATIVELY SUITED TIMBER LANDS

The purpose of identifying tentatively suited timber lands is to determine how many acres the Forest has--now and in the future--that can sustain a nondeclining flow of timber indefinitely. The determination of tentatively suited timber lands identifies those stands of trees which are biologically capable and available (that is, have not been withdrawn for recreation, wilderness or other reasons) for timber production

The determination of tentatively suited lands was accomplished by a new invenstory of the timber stands on the Forest During the re-inventory, the district timber staffs identified individual timber stands as either tentatively suited for timber production, or classified the stands into one of the three following categories

- Forest Land Withdrawn From Timber Production.
- Forest Land Incapable of Producing Industrial Wood.
- Forest Land Not Physically Suited For Timber Production

Table III-3 identifies the acres of forested land in each of the three categories. The amendment process has identified an additional 61,359 acres as tentatively suited for timber production The increase is due to the more thorough and current timber inventory used for the amendment process

The identification of tentatively suited lands does not include a determination of whether or not these lands are economically efficient at producing timber The economic determination occurs when suited timber lands are identified Suited timber lands on the GMUG will always come from the tentatively suited lands

Examination of the Financial Efficiency of Tentatively Suited Timber Lands

Financially efficient timber stands are those from which the estimated total receipts equal or exceed the direct timber costs Estimated receipts are the high bid value of the timber (the cash paid plus the effective timber purchaser road credit). Direct timber costs include the costs of setting up and administering timber sales, the costs for planning and building logging roads, the timber support costs from other resource specialists, and the costs for reforestation, thinning, and other silvicultural treatments

In general, financial efficiency determines whether or not logging will produce a profit for the Forest

A profit for every timber sale is not always the same as being financially efficient. For instance, the first step of a financially-efficient, three-step-shelterwood spruce-fir harvest might have a negative cash flow, while steps two and three have positive cash flows. The first step would be negative because the volume removed was relatively low, and most road construction costs would occur in the first step. Because steps two and three would produce profits greater than the loss incurred in step one, the harvest would be profitable. All financially efficient clear cut harvesting also has a positive cash flow.

The financial analysis determined that the Forest presently has no financially efficient timber lands and will have none over the next 150 years using historic average prices (historic average timber prices were used throughout the benchmark and alternative analyses)

Realizing that timber prices are constantly changing, the Forest conducted a financial analysis on the break-even price range for both suited and unsuited lands within the tentatively suited land base. The analysis compared prices for all of the classes of unsuited and suited lands In calculating the prices, total costs (excluding fixed costs) were divided by the total timber volume (MBF) Table III-4 displays the break-even prices

TABLE III-4

BREAK-EVEN PRICE ANALYSIS

	Surface Rock	Isolated Patch	Low Prod-uctivity	High Road Costs	Other Resource Values	Suited Lands
Total Costs	$994,000	$6,225,000	$1,057,000	$23,366,000	$4,240,000	$20,683,000
Sawtimber Volume(MBF)	11,925	56,295	6,272	195,066	57,699	282,213
POL Volume(MBF)	5,324	53,844	9,261	213,896	37,116	218,408
TOTAL VOLUME	17,249	110,139	15,533	408,962	94,815	500,621
Break-even Price Cost/Volume	$57 63	$56 52	$68 05	$57 13	$44.72	$41.31

The actual prices used in the benchmark and alternative analyses are conservative in comparison to current prices For example, in the analyses spruce-fir is assumed to be priced at $21 54/MBF, but it is currently selling at prices up to $67 00/MBF If the current stumpage rates increase above the break-even prices displayed above, financially efficient acres will be found on the Forest.

Examination of the Economic Efficiency of Tentatively Suited Timber Lands

The timber economic efficiency analysis includes the timber and water benefits that result from timber management minus the associated costs Other benefits, such as recreation, would not be affected by different timber sale levels Ninety-two percent of the tentatively suited acres were found to be economically efficient When non-declining flow, management requirements, and other standard benchmark constraints were added to create Benchmark 3A, the decade-one efficient level of timber production was found to be 26 MMCF (119 MMBF) This level of timber production greatly exceeds expected future demand (67 MMBF)

Placing demand cut-off constraints into the analysis cuts the decade one allowable sale quantity roughly in half (a reduction from 119 MMBF to 67 MMBF) With demand cut-off points included timber efficiency is determined primarily by timber and water benefits. These are approximately equal in importance Adding water benefits to the efficiency calculations of a timber sale is roughly equal to doubling the value of the timber Range and big game contributions to timber efficiency are minimal since they contribute benefits only when timber harvesting helps maintain existing demand levels for range and big game Also, forage on lands unsuited for timber provides for most of the demand from livestock grazing and wildlife

Summary of Suitability Analysis

In summary, the first step of the timber suitability analysis identified 1,253,541 acres of tentatively suited timber lands. None of the tentatively suited acres are financially efficient, while 19% are economically efficient. The timber efficiency analysis provided little direction in formulating alternatives since so many of the tentatively suited lands were economically efficient, but and none were financially efficient at historic prices.

DEMAND TRENDS

Twenty-seven mills purchase timber from the Forest. Table III-5 displays mill locations and the percent of timber purchased annually from the Forest They range in size from a 32 million board foot (MMBF) waferwood plant to a 55 MBF mill which makes house logs. The two largest mills (Louisiana Pacific and Blue Mesa Forest Products) account for 46% of the current local demand Stone Forest Industries, located in South Fork, Colorado near the Rio Grande National Forest, also accounts for a portion of the future demand, especially on the southeast part of the GMUG.

TABLE III-5

PERCENT OF TIMBER OFFERED ANNUALLY BY GMUG THAT WAS PURCHASED BY MILL LOCATION

MILL LOCATION	PERCENT OF TIMBER PURCHASED ANNUALLY
Montrose Area	62%
Delta	10%
South Fork	7%
Paonia Area	5%
Alamosa	5%
Gunnison Area	3%
Grand Junction	2%
Saguache	2%
Norwood	2%
Mesa	<1%
Creede	<1%
Howard	<1%

Five product categories were analyzed in the Amendment process (Note POL = Products Other than Logs)

1. Conifer sawtimber
2. Conifer Products Other than Logs (POL) not used for waferwood.
3. Conifer POL sold for waferwood. This is entirely lodgepole pine.
4. Aspen POL waferwood
5. Aspen sawtimber.

The NFMA Planning Regulations state that "to the extent practicable," price-quantity relationships will be used to determine timber demand. The analysis indicates that such a relationship may exist on the GMUG, but it could not be identified statistically.

Timber demand was determined in different ways due to different products, the quality of data available, and the nature of the products. The different product categories included conifer sawtimber, aspen sawtimber, conifer POL and aspen POL.

The analysis involved the determination of current demand the quantity being harvested now), as well as expected future demand. The expected future demand is the expected harvest level projected for the next two decades.

The methods used to calculate current timber demand included both the historic analysis of harvest levels and professional judgement

Demand for aspen and conifer sawtimber as well as non waferwood POL was determined through the analysis of historic records tempered by professional judgement. Projections of future demand for conifer sawtimber are based largely on existing under-utilized mill capacity

The demand for aspen and conifer waferwood had to be determined through the use of a Colorado State Forest Service (CSFS) mill study (CSFS 1987) which was also tempered by professional judgement

A complete description of the timber demand determination process is found in Appendix B pages B-71 - B-82.

Table III-6 identifies timber demand by the four product categories determined to exist on the Forest. The table displays current demand and estimated average demand for the first decade The figures for the first decade include an average projected growth in the industry of 27%.

TABLE III-6

TIMBER DEMAND
(Demand on the GMUG only in thousand board feet/year)

	*Past 5 Years	Estimated Current Demand	Expected Future Demand
Sawtimber	21,000	21,000	29,600
Aspen POL **	11,600	28,800	31,000
Conifer POL ***	1,300	1,300	4,400
TOTAL	33,900	51,100	65,000

* Aspen POL historic harvest level does not reflect industry demand because of appeals and settlement agreements which have held offerings at a lower level

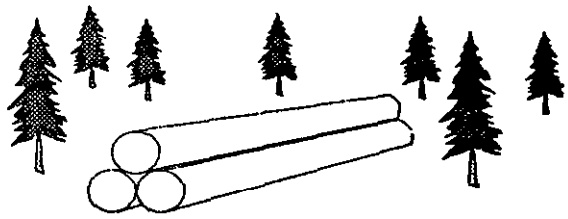
** 90% aspen 10% lodgepole pine

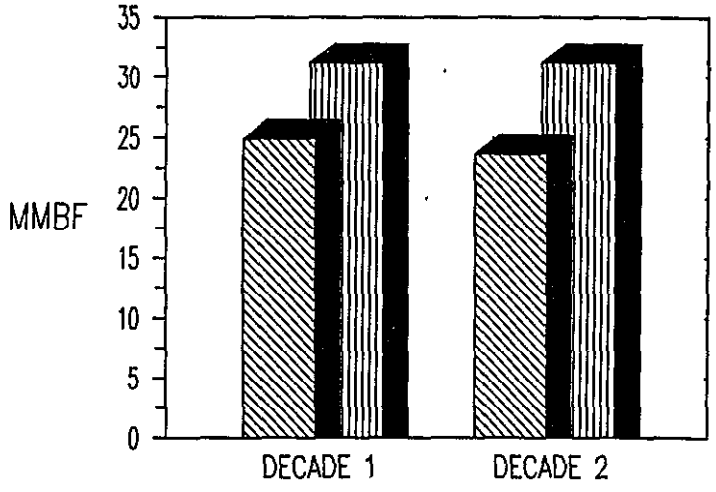
*** includes 1,000 MBF of post and poles and 300 MBF of aspen products

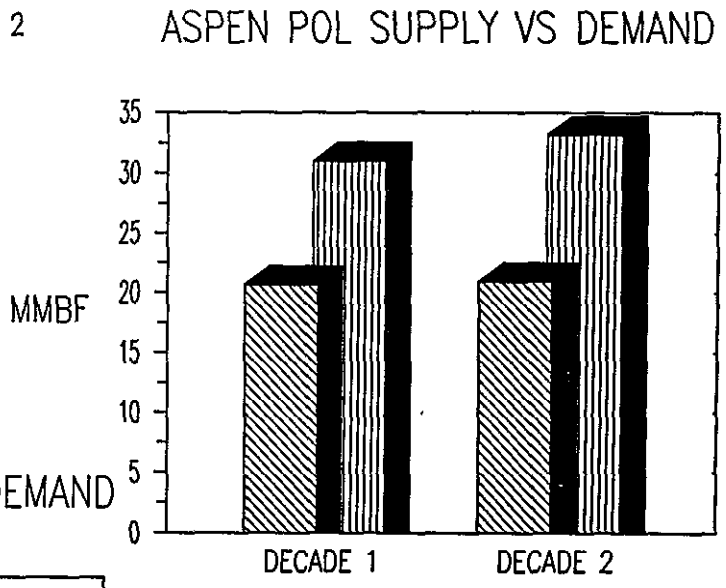
The Forest Service believes that the level of conifer sawtimber harvest will rise as a result of both the expansion of Blue Mesa Corporation's mill and Stone Container Corporation's desire to build a kiln at their mill in South Fork Volume under contract has decreased recently, but slightly more than a three year supply remains under contract.

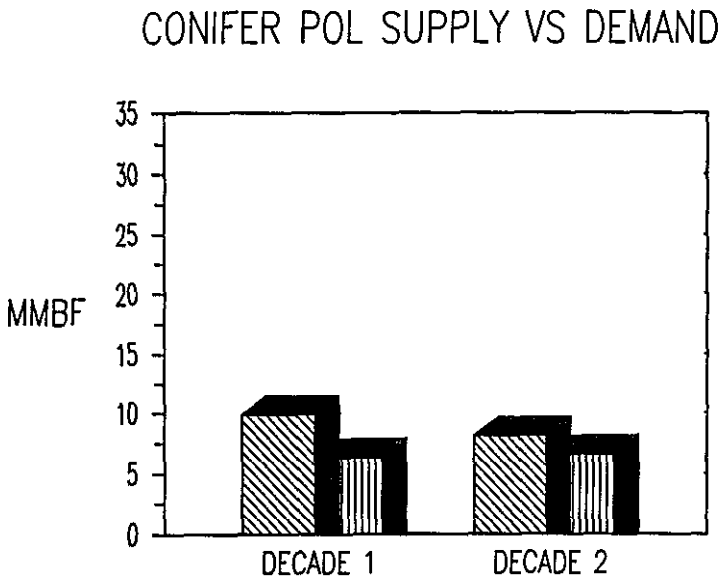
Figure III-6 compares timber demand with timber supply Timber supply was determined as the maximum biological potential of tentatively suited timber lands. In two cases potential supply is less than expected future demand Supply for sawtimber is 80% of demand in decade one and drops to 76% in decade two Supply for aspen POL is 67% of demand in decade one and drops to 63% in decade two. Conifer POL is the only case where supply exceeds demand --- 3 69 MMBF in decade one and 1.55 MMBF in decade two.

*Timber Demand Vs Supply**









CLIMATE

The climate of the Forest is a continental mountain climate. Most precipitation on the Forest falls as snow, with afternoon thundershowers contributing some moisture during the summer Much of the snowfall is due to the orographic lifting of Pacific air masses as they pass across the Rockies. There is little opportunity for influencing climate, in these terms, through management activities

Forest elevations range from 6,000 feet to above 14,000 feet Suitable timber lands are generally located in the 7,500 to 11,000 foot elevation range. Growing seasons are short. The metabolic rates of growing trees are slow compared to those of lower elevation forests The contribution of the forests of the entire Rocky Mountain region to the oxygen/carbon dioxide balance in the atmosphere is important. Healthy, vigorous forests process more carbon dioxide and produce more oxygen.

The over all health of the timber stands on the GMUG is declining. Many stands of trees are aging, and their vigor is declining. Regeneration of portions of the Forest would restore them to a healthy and vigorous condition and would enhance the Forest's contribution to the oxygen/carbon dioxide balance.

SOILS

GEOLOGY, GEOMORPHOLOGY AND PHYSIOGRAPHY

The forest is situated between two physical areas. (See FEIS Chapter III, Page III-1): the Southern Rocky Mountain province to the east and the Colorado Plateau province to the west. As a result a great variety and complexity of landforms, geomorphic situations and geologic material occur on the Forest. Broad basins, mesas, and canyons blend into the rugged uplifted mountains The geologic material is also a blend. The shales and sandstones of the canyon country have been uplifted and intruded into basalts, intrusive igneous, and volcanic materials in the mountainous areas This has created a complex mix of geomorphic and geologic situations.

The landforms and slopes of the mid to western portions of the Forest are influenced by shales of varying geologic ages. The predominant shales (primarily Mancos and Wasatch) consist of soft, fine-textured clay materials laid down by ancient seas. These soft shales often give way under changes in environmental or geologic situations.

As a result of past geologic activity (geologic uplifting, intrusions into, past climatic changes). The landforms in some areas are dominated by slumps, slump blocks, mud slides, and other slope-failure situations.

SOIL RESOURCES

The soils of the forest are as complex and variable as the landform and geologic parent material that has helped form them. The specific characteristics that a particular soil will have depends on how the factors of climate, vegetation, and topography have affected a geologic material.

The supply of soil is essentially fixed, renewing itself by the slow weathering of bedrock over periods of several hundreds, possibly thousands, of years.

The Forests' role is to conserve this fixed supply of soil by minimizing soil damage that could occur as a result of various multiple use activities This conservation can be accomplished by inventorying the soil characteristics, monitoring how prescriptions affect a specific soil type and providing mitigation measures to prevent and reduce damaging situations.

Forest Condition

Until recently very little soil data was available even for general characteristics and classification of the Forest's soil.

The Forest is actively participating in the National Cooperative Soil Survey (NCSS) process. Data is being gathered for the Forest Service by the Soil Conservation Service's (SCS) Soil Survey Department through this effort.

The SCS is the lead agency in developing and employing soil survey procedures in the United States. As a result of this effort, the data gathered about the soil resource on the Forest will be correlated and evaluated at national standards with the best current knowledge This is providing a general base of information from which indications of soil hazards, limitations, and potentials can be obtained.

Soil Erosion

The erosion hazard is a rating given to a soil or activity which provides an indication as to how easily the soil erodes or the potential of the activity to cause erosion. In determining the soil erosion hazard for a soil, a number of specific soil characteristics are evaluated. These include the following. texture, organic matter content, structure, permeability, amount of coarse fragments, slope length, slope steepness, and rainfall amount and intensity. Each situation, on any specific area, will have a unique combination of features that create the potential for erosion

The hazard rating is not a rating of natural erosion occurring on a soil. Instead, this rating assumes that the surface cover of vegetation (or leaf litter) has been disturbed or destroyed and that the bare surface soil has been exposed to the forces of erosion

Hazard ratings are usually described as low, moderate, or high

- A rating of *low* means that the soil has a good mixture of sand, silt, and clay and has good organic matter content These soils are on gentle to moderate slopes and do not usually require costly erosion control measures

- A rating of *moderate* indicates that the soils have moderate inherent erodibility characteristics and/or occur on moderate to steep slopes. These soils are more easily detached and moved by raindrop impact or by flowing water and may require more planning and expense to control.

- A rating of *high* indicates that the soils have moderate to high inherent erodibility characteristics and occur most often on slopes ranging from moderate to very steep In these situations the soil particles, after disturbance, are very easily detached and moved by rainfall and overland flow. Areas with this rating usually need special planning and efforts to control erosion

Due to the variability in materials, slopes and landforms, the erosion hazards for soils on the Forest range from *low* to *high*. Preliminary soils data gathered during the recent soil survey effort indicates that the inherent erodibility of the soils in the area is generally on the low to moderate end of the scale (K values range predominantly from .10 - .30). The most prevalent erosion hazard rating, however, occurs at the moderate to the high end of the scale This is due, in part, to the occurrence of steep slopes in the canyons and mountain areas

Slope Stability

Large areas of ground on the Forest have experienced and continue to experience slope movements These slope failure situations are most prevalent in the western, southern, and northern one-half to two-thirds of the Forest on the soft marine shale geology that occurs in these areas The land in these areas was uplifted and then downcut and eroded away This resulted in a variety of geologic material being exposed The shales are softer and weaker than most of the other geologic materials These shales are usually the first component to fail, especially if left in over-steepened situations Examples of these situations are canyon sideslopes, flanks of uplifted areas, or situations where volcanic or glacial materials are top-loaded and occur above the shales This arrangement of geomorphic and geologic situations has resulted in the formulation of large slope failure complexes which account for major land form areas on the Forest All of the following recognized slope failure situations can be found in the area· rockfalls, rockslides, debris slides, slumps, earthflows, rotational slides, translational slides, blockslides, and soil creep These are generally large scale features which have occurred as a result of past geomorphic and climatic situations

Examples of large-scale situations include the Slumgullion slide, the upper reaches of the Muddy drainage, and the south and north flanks of Grand Mesa These areas are still experiencing slope movement but at a greatly reduced level.

Other areas of slope failure have become apparent as a result of the construction of roads in the area Examples include the McClure Pass vicinity, the Tabeguache Basin, the Buzzard Divide - Hightower Area, and Owl Creek Pass The amount of slope movement appears to be directly related to the ups and downs of current weather patterns The wetter the year, the more the slope moves

Other potential slope failure situations have not occurred yet. These slopes will generally fail if they are disturbed or become unbalanced by some external force (i.e , roads, trails, or extra amounts of moisture). This type of slope failure accounts for small scale slumps or slides.

During the past 80 years of various levels of management on the Forest very few, if any, major slope failures have occurred as a result of man's activities Most of the major landslides occurred in the geologic past, and what we see today is the result of those failures In most cases man's activities have developed around or across them This has created maintenance problems and costs.

More recent smaller slope failures have occurred throughout the area Generally these have been related to above normal precipitation events and years

Soil Productivity

Soil productivity is defined as the inherent capacity of a soil to support a defined level of growth of specific plants, plant communities, or sequence of plant communities The specific level of productivity depends on available soil moisture, available nutrients for plant uptake, soil texture and structure, organic matter content, climate or length of growing season and, to some degree, the effects of past management practices

The specific productivity of soils on the Forest varies depending on the plant community, elevation, geologic influence, amount of precipitation, and past treatments and management

Generally the soils on the Forest possess moderate to moderately high fertility compared to the rest of the region

The most productive zone, of the Forest is in the aspen vegetation type on the western half of the Forest The geologic materials involved are sedimentary shales and interbedded sandstones These weather into very productive, *resilient soils, and, in most cases, revegetate relatively easily*

Other areas, however, are not as productive and do not revegetate easily. Often, these less fertile areas occur at elevations above 11,000 feet and at lower elevations between 6,000 and 7,000 feet

AIR QUALITY

Air quality over most of the Forest is good The main source of pollutants from Forest activities are, and will continue to be, suspended particulates from wildfire and prescribed burning External sources of air pollution are dust from roads and exhaust emmissions from internal combustion engines

Through the "Prevention of Significant Deterioration" provisions of the Clean Air Act (42 USC 1857, et seq), Congress has established a land classification scheme for areas of the country through the use of air quality standards. Class I *allows very little additional deterioration of air quality; Class II allows for more* deterioration, and Class III allows for still more All areas of the Forest are currently classified Class II except for portions of the West Elk Wilderness and the La Garita Wilderness, which are Class I areas

Future energy related developments and associated population growth in the area are expected to have a detrimental effect on air quality in the Forest

A protection discussion of the Fossil Ridge Wilderness Study Area and the Cannibal Plateau Further Planning Area is contained in the Wilderness section of this chapter.

WATER YIELD

The importance of water in the arid west is receiving increasing attention as demand increases substantially and the available supply remains relatively constant. The water yield from the Forest accounts for an estimated 40% of the Colorado River flow at the Colorado and Utah border.

Current water yield from the Forest is approximately 2.87 million acre feet/year. Of this, 16.4 thousand acre (.65%) feet is thought to be the increase above baseline (natural pristine condition) yield that has been created by management

Water augmentation occurs as a result of the following commercial logging practices:

- clearcutting in lodgepole pine and aspen
- shelterwood harvests in spruce/fir and lodgepole pine

DEMAND

The demand analysis involved the production of water from National Forest lands for downstream users. No distinction was made between users adjacent to the Forest and those which were out of state. Water production was measured in acre-feet.

The Water Resources Planning Act of 1965 directed the U.S. Water Resources Council to maintain a continuing study of the Nation's water and related land resources and to prepare periodic assessments to determine the adequacy of these resources to meet present and future water requirements. The present analysis used the Second National Assessment, related specifically to the Upper Colorado Region, in determining future demand estimates for water in the Forest's planning area.

The following discussion is excerpted from the report titled "The Nation's Water Resources 1975 - 2000"; Volume 4: Upper Colorado Region; Second National Water Assessment by the U S. Water Resources Council. Page 14 of the report states: "Total consumption will increase 32 percent in the next 25 years. Two important water uses in the Upper Colorado Region that deplete streamflow are exports and evaporation from reservoirs."

The report, page 15, continues with: "Total Upper Colorado Region commitments including intraregion withdrawals, reservoir evaporation, exports to adjacent regions in Arizona, Colorado, New Mexico, Utah, and Wyoming, and deliveries to the Lower Colorado now exceed the 'virgin flow' at the outflow point of the region....If the states are to develop natural resources at the SRF (State/Regional Futures) rates and according to other expressed aspirations, severe water shortages will develop in a time frame that directly affects planning and development decisions being made today."

The report concludes, page 19, that: "The water supply in the Upper Colorado Region is not sufficient to meet projected needs, adequate instream flows, and the terms of the Colorado River Compact", and on page 23, that: "The Continental transfer of water to large growing population centers outside the region in eastern Colorado, western Utah, Wyoming, and New Mexico will create conflicts with projected in-basin (in-region) users over an insufficient water supply."

A current proposal by Aurora, Colorado would divert up to 108,500 acre-feet annually from the upper Gunnison River to the Colorado Front Range. This annual diversion is greater than the water augmentation capability of the Forest.

Water was valued at $34 14 (1982 dollars) for each additional acre foot of water produced through vegetative management Determining a water augmentation benefit value is complex The timing of peak flow, Colorado River compact constraints, and evaporation cause make it impossible for the full increment of water produced by the Forest to be used The GMUG water benefit value takes this into account The water value times additional water produced equals the value of the water actually used within the Colorado River basin (see paper titled "Marginal Economic Value of Runoff From the Grand Mesa, Uncompahgre, & Gunnison National Forests by Thomas C. Brown: Rocky Mountain Forest and Range Experiment Station· Fort Collins, Colorado; and Benjamin L. Harding & Elizabeth A Payton, WBLA, Inc , Boulder, Colorado. May, 1988.). Appendix B displays the factors used to calculate the value for water.

WATER QUALITY

Currently, 95% of the water flowing through the Forest meets water quality standards. Water not meeting standards is affected by toxic metallic pollutants from past mining activities, from natural sediment loads in the "Muddy" country around Paonia, and from isolated unstabilized roads that have been recently constructed.

RANGE

This supplements the FEIS, Chapter III, pages III-83 through III-85

DEMAND TRENDS

Due to the uncertain future of the local grazing industry and the relatively flat use trends of the past, a three year average (since the Plan was put into effect) was used to represent current and future use This time period best represents the uncertain livestock market Estimated livestock use of the Forest, as measured in AUM's, is expected to decrease from the current 340.0 M to 250 0 M by the year 2000. Recovery of the grazing industry will be slow, but projections indicate that permits should increase and level off at approximately 300.0 M by the year 2030. As a note of reference, the total actual use in 1989 was 267.5 M AUM's.

ROADLESS AREAS

The RARE I and RARE II processes, completed in 1979, inventoried and evaluated for possible wilderness designation 53 roadless areas on the Forest. These areas contained 1,523,780 acres In 1980, 374,900 acres of RARE II inventory lands on the Forest were classified as wilderness by the Colorado Wilderness Act (Public Law 96-560). The Act further identified Fossil Ridge (RARE II # 02204), consisting of 54,700 acres, a Wilderness Study Area and Cannibal Plateau (RARE II # 02218), consisting of 31,990 acres, a Further Planning Area. Recommendations concerning wilderness designation for these areas were made as part of the analysis for the the Forest Plan. A portion of the Cannibal Plateau (13,599 acres) was recommended as suitable for wilderness while the Fossil Ridge Wilderness Study Area was recommended as suitable for wilderness. The Fossil Ridge area is being managed in ways that will maintain its wilderness character until Congress acts. All other lands inventoried as roadless in the RARE I and II processes were released for non-wilderness management.

Approximately 950,000 acres of the Forest are currently roadless.

Several former RARE II areas have been specifically mentioned during the Keystone Process as sensitive areas." These areas include the Kannah Creek, Tabeguache and Roubideau RARE II areas. The RARE II Final EIS recommended these areas as suitable for wilderness.

Kannah Creek (02195) contains 29,650 acres and is located on the west end of the Grand Mesa. It includes much of the City of Grand Junction's municipal watershed. For this reason management has been centered around protection of the water resource and no timber management has occurred. The area does not contain a large, valuable supply of timber.

Tabeguache (02242) contains 10,240 acres and is located on the west side of the Uncompahgre Plateau The area is one of rugged canyons with limited access, moderate timber value, and minor water yield potential.

Roubideau (02241) contains 19,780 acres and is located on the east side of the Uncompahgre Plateau The area is characterized by rugged canyon-type topography. The area has moderate timber potential with aspen occurring at the upper reaches of the canyons where access is not a problem. A portion of the lower elevations are big game winter range.

ROADS

The information presented here supplements the FEIS, Chapter III, pages III-106 through III-109

As a result of the Keystone Process, the Forest agreed to display in this document information detailing the miles of open and closed roads on the Forest. The Forest System Road Inventory includes a total of 3971.4 miles of road as of April 1988 Of this total, 369.1 miles of road are physically closed but will remain on the inventory for possible resource management needs. Table III-7 displays the roads on the Transportation System Inventory by Ranger District and whether they are open or closed

TABLE III-7

PERCENT OF MILES OF ROAD OPEN/CLOSED BY RANGER DISTRICT (AS OF APRIL, 1988)

Ranger District	Miles Open	% of Miles Open	Miles Closed	% of Miles Closed
Cebolla	790 4	91	81 3	9
Collbran	201 6	99	2 5	1
Grand Junction	380.9	98	8.6	2
Norwood	655.7	96	25.9	4
Ouray	509.0	85	90.5	15
Paonia	346.6	88	46 6	12
Taylor River	718.1	91	113.7	9
Forest Total	3602.3	91%	369.1	9%

VISUALS/SCENERY

The GMUG National Forests contain a great variety of landscapes which are visible from many viewer locations These viewer locations include highways, roads, trails, developed recreation sites, lakes and rivers, mountain tops, ridges, and communities. Nine characteristic landscape sub-types are found on the Forest·

SR2	Collbran Valley Brushlands,
SR5	Gunnison Basin Brushlands,
SR10	Uncompahgre Pinyon Juniper Plateau Lands,
SR-18	San Juan Range Forestlands,
SR-19	Uncompahgre Plateau Forestlands,
SR-20	West Elk Forestlands,
SR-20a	Grand Mesa Forestlands,
SR-26	Central Colorado Continental Divide Lands, and
SR-27	San Juan Range Divide Lands.

The Forest's landscapes display forests, rangelands, mountains, and rivers in their natural state. Most landscapes contain unobtrusive signs of human activity. About one-half of one percent of the Forest's landscapes are dominated by signs of past or present human activity.

VISUAL QUALITY OBJECTIVES

The Forest uses the National Forest Visual Inventory System to manage its visual resource. The principal inventory in this system is the Visual Quality Objective (VQO) inventory. The Recreation Opportunity Spectrum (ROS) is the system designed to integrate recreation values into National Forest Plans, project designs, and management decisions.

Visual Quality Objectives (VQO) have been established for the Forest based on characteristic landscape, the physical features of the land, and people's concern for scenic quality. The Visual Quality Objective inventory for the Forest is made up of the following percentages:

Preservation - 15%
Retention - 6%
Partial Retention - 19%
Modification - 56%
Maximum Modification - 4%

The Forest Service Manual, 2311.11 exhibit 1, displays the ranges of VQO that correspond to Adopted ROS Classes. The forest ROS class inventory is a base line inventory and has not been adopted by management as an ROS class direction. Until the ROS class inventory is adopted by management, the crosswalk between VQO and ROS will be analyzed only at the project level.

RECREATION OPPORTUNITIES

Dispersed recreation is the only element of the recreation program that would be affected by the alternative proposals addressed in this analysis. Developed recreation and downhill skiing are not addressed in this SEIS. Wilderness recreation is addressed only as it would be affected by areas lost from the semi-primitive "ROS" classes.

Recreation settings are managed on the Forest to provide opportunities for a wide variety of recreational experiences. Table III-8 displays the setting components necessary to produce recreational experience opportunities. These include physical, social, and managerial attributes.

TABLE III-8

SETTING COMPONENTS
Physical Natural forest setting (environment) Facilities such as campgrounds, roads, trails
Social Relative number of people, congestion Competition for space Behavior of groups Activities Available information

TABLE III-9

SETTING COMPONENTS
Management
Condition of Facilities
Regulations
Responsiveness to needs
Perception of land stewardship

The various setting components have been organized into the Recreation Opportunity Spectrum (ROS). The ROS provides a framework for defining or describing different classes of outdoor environments, activities, and experience possibilities. The principal classes include primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, and rural.

Areas which are managed under the different Recreation Opportunity Spectrum Classes can absorb only as much impact from timber and other management activities as is compatible with the corresponding recreation opportunities featured in these areas.

For example, in areas designated as primitive, appropriate access would generally be by cross country travel. Because the visual quality objectives are preservation in classified wilderness areas and retention in unclassified Forest areas, all management activities must not be noticeable to the casual forest visitor.

In a semi-primitive nonmotorized area, trails and some primitive roads are compatible. Although management activities can take place, they must blend with the surrounding landscape.

In semi-primitive motorized areas access is by primitive and controlled access roads. Management activities must blend with the surrounding landscape. They may, on occasion, dominate the landscape but should blend with the line, form, color and texture of the surrounding landscape.

In roaded natural, rural, and urban areas, controlled access roads and full access roads are compatible. Management activities may be visible to observers and the management activities at times may even dominate the landscape, but the lines, forms, colors and textures created must blend with the surrounding landscape character.

If these criteria cannot be met, effects will occur which will require a change in ROS class or mitigation.

TABLE III-10

DISPERSED RECREATION DEMAND (Replaces FEIS Table III-10)
(RVD's Per Year)

	Time Period		
	1985	1988-1997	1998-2037
Hunting	265,300	318,575	374,598
Fishing	204,400	239,659	286,671
Off-Road Motorized	485,600	549,068	632,834
Other	116,700	132,447	153,435
Total	1,072,000	1,239,749	1,447,538

TABLE III-11

CURRENT DISPERSED RECREATION ACRES AND CAPACITIES
(By ROS Class)

ROS Class	Acres	Theoretical Capacity(MRVD's/Yr.)
Primitive	218,000	37
SPNM	772,000	510
SPM	1,222,000	807
Roaded Natural	707,000	12662
Rural	33,000	2128
Totals	2,952,000	16144

Recreation Demand and Supply Compared

When projected demands and potential capacity are considered, the Forest provides ample dispersed recreation capacity to meet reasonable expectations of future use. The total Forest capacity of 16 million RVD's compared with the total projected demand of 1 to 1.5 million RVD's suggests that no supply problem exists. However, if the recreation capacities are examined separately, projected recreation use within the primitive and semi-primitive ROS classes (excluding wilderness) appears to approach potential capacity by the end of the fifth decade.

Recreation Demand and Supply Compared

When projected demands and potential capacity are considered, the Forest provides ample dispersed recreation capacity to meet reasonable expectations of future use. The total Forest capacity of 16 million RVD's compared with the total projected demand of 1 to 1.5 million RVD's suggests that no supply problem exists. However, if the recreation capacities are examined separately, projected recreation use within the primitive and semi-primitive ROS classes (excluding wilderness) appears to approach potential capacity by the end of the fifth decade.

There are selected areas on the Forest where semi-primitive recreation opportunities are limited, or highly valued, and reductions of semi-primitive opportunities would be felt more in these than in other areas These areas include portions of the Uncompahgre Plateau, Kebler and McClure Passes, the base of the Mt. Sneffels range, and the Silver Jack area In these areas, the semi-primitive users perceive a threat that could be considered a true conflict among forest users

The major limiting factors on recreation experience are the amount of population increase, the intensity of use on specific sites, and the time of the year, such as during hunting season. The intent of recreation management on the Forest is to encourage low impact use dispersed across the Forest This is the existing pattern of use with very few areas of concentration and no situations of overuse

Wilderness use on the Forest is well within accepted limits of use This resource is in excellent condition with few areas experiencing enough concentration of use to affect the resource. Application of Forest Plan Standards and Guidelines in these areas is expected to protect and enhance the wilderness resource

FISH AND WILDLIFE

FOREST CONDITION

An important objective of wildlife habitat management on the National Forests is to maintain and/or enhance the diversity of habitats. Diversity provides structure and composition for animal habitat, resistance against epidemics, and increased resilience after disturbance This objective serves the long-term goal of maintaining viable populations of all native species on the Forest

A high level of public interest and concern is present for the Forests' big game management program, specifically for elk, deer, and bighorn sheep Winter range habitat capability is the limiting factor for the elk and deer population on private as well as public land. Less than 10 percent of the elk and deer that summer on the Forest winter on the National Forest due to climatic conditions Therefore, activities which maintain and/or enhance habitat capability on known winter ranges are emphasized. Effective habitat for elk and deer on all seasonal ranges is a factor of available forage, cover, and amount of human disturbance (collectively termed habitat effectiveness) The amount and design standard of open roads provides a good indicator as to the level of human activities to be expected in an area and the degree of habitat effectiveness that area holds for elk and deer Wildlife species which are displaced or disrupted by daily human activities cannot fully benefit from either natural or created habitat diversity, cover, or forage Without a sufficient degree of habitat effectiveness, these animals may be displaced to adjacent areas; some of these areas may be undesirable or unacceptable due to conflicts with other resources and/or management This is of particular concern if activities on the Forest force the animals to move to private lands where they interfere with landowner operations.

The opportunities to increase the carrying capacity for deer and elk through a commercial timber sale program on the GMUG are minimal Most commercial timber lands occur on the higher, more moist summer ranges while the carrying capacities for these animals are limited by the lower and dryer winter ranges Only a small portion (9 48%) of the total winter range in the planning area for these species is located on National Forest System land; the majority of winter range is on BLM and private land The Forest's current carrying capacity (limited by winter range) is 2,033 elk and 5,806 deer This number was determined in cooperation with the Colorado Division of Wildlife While many more animals do live on the GMUG during the summer months, the Forest's ability to provide year-round habitat is limited to the winter range capacities. Current elk and deer populations are at or above the winter range capacities

Table III-12 shows the relationships that exist between winter range and tentatively suited timber lands.

While timber sales on summer ranges do not increase carrying capacities for big game, they do provide the opportunity to improve the quality of the habitat by increasing species diversity and species distribution.

TABLE III-12

WINTER RANGE

Total acres of winter range in the planning area (includes other ownerships)	3,800,000
Total GMUG winter range (9 48%)	360,548
Tentatively suited commercial timber lands on winter range	
Ponderosa Pine	*44,240*
Aspen	*39,959*
Total (23%)	84,199

(Of the 1,253,541 acres of tentatively suited timber lands on the Forest, seven percent are on winter range.)

RIPARIAN

Riparian zones can be identified by the presence of vegetation that requires free water or by conditions that are more moist than normal (Thomas et al 1978) These zones include streams, lakes, and wet areas, and the adjacent vegetative communities which are predominantly influenced by their association with water (Riparian Habitat Subcommittee of the Oregon/Washington Interagency Wildlife Committee (R H S) 1979). They are characterized by species and/or life forms that are different from those of the immediately surrounding non-riparian climax area (Lowe 1964, as cited by Brown et al. 1977)

Presently, an effort is under way to catalog, type, map and inventory all of the Forest's high priority riparian areas (aquatic ecosystems and riparian ecosystems) Until these inventories are completed, the only data available that can be used to address the current conditions of these habitat types are historical data or monitoring results associated with site specific activities. No data are presently available that would allow the Forest to state, with any degree of certainty, the over-all current condition of the Forest's aquatic and riparian systems

In general, the riparian areas on the Forest vary considerably in diversity, stratification and condition They range from grass/forb/willow communities to shrub/deciduous tree/conifer communities Based on historical data, the condition of these riparian systems appears to range from fair to good. These conditions can be affected by the association between the riparian system and the timber sale unit.

AQUATIC RESOURCES

The Forest's aquatic wildlife (fisheries) resources consist primarily of common trout species such as brook, brown, rainbow, and cutthroat. Non-game fish species include suckers, dace, and sculpin and occur in a variety of aquatic habitats. Aquatic and semi-aquatic macroinvertebrates are an integral part of the aquatic resources of the Forest and provide the major food source for the fisheries throughout the Forest

As with the riparian habitat condition, the current condition of the Forest's aquatic habitat in unknown. This information will, however, be available once the inventories named above have been completed. The only aquatic inventories that have been conducted recently have been associated with site specific project work and do not reflect the general condition of the Forests' aquatic systems. Table II-13 presents a description of the Forests' aquatic and riparian resources

In general, timber harvesting activities have the potential to affect fisheries habitat by degrading water quality and increasing sediment as a result of road construction, skid trails, culvert placement, site access, road encroachment, and removal of riparian vegetation

THREATENED AND ENDANGERED SPECIES

The Endangered Species Act of 1973 requires all Federal departments and agencies to conserve threatened and endangered species. Table III-13 below lists the federal and state designated plant or species which may occur on, or be closely associated with, the Forest

TABLE III-13

THREATENED AND ENDANGERED SPECIES

COMMON NAME	SCIENTIFIC NAME
American Peregrine Falcon	*Falco peregrinus anatun*
Spineless Hedgehog Cactus	*Echinocereus triglochidiatus* var. *inermis*
Whooping Crane **	*Grus americana*
Greater Sandhill Crane**	*Grus canadensis tabida*
Wolverine ***	*Gulo gulo*
Bald Eagle	*Haliaeetus leucocephalus alascanus*
Lynx***	*Lynx canadensis*
Colorado R. Cutthroat Trout*	*Oncorhynchus clarki pleuriticus*
Colorado R Squawfish***	*Ptychochellus lucius*
Humpback Chub***	*Gila cypha*
Razorback Sucker***	*Xyrauchen texanus*

* Listed on state list as "species of special concern"
** Migrant occurrence
*** Doubtful existence on the Forest

The bald eagle is presently the only threatened or endangered animal species which may have regular, year-around occurrence on the Forest; however, summer occurrence is rare. The hedgehog cactus does occur on the Forest with known locations identified Additional populations which have not been identified may also occur on the Forest. A sensitive species, the Uncompahgre fritillary butterfly (*Boloria acronema*) is under consideration for Federal designation as a threatened species. One known population currently exits on the Forest. Annual studies are being conducted on this species, and additional populations are being sought under a cooperative program with the BLM, U.S. Fish and Wildlife Service, the Colorado Natural Areas Program, and Montana State University The Colorado River cutthroat trout was taken off Colorado state's "Threatened" list and placed on the state "Species of Special Concern" list. Populations exist on the Forest, however and the known extent, range, and current status of the population densities are limited.

FOREST INSECTS AND DISEASE

The most prevalent insect pests on the Forest are the Engelmann spruce bark beetle, the mountain pine beetle, and the Western spruce budworm. Serious outbreaks of these pests have occurred in the past. Currently, the mountain pine beetle is causing losses on the Uncompahgre Plateau. This epidemic has been, and is currently being, controlled by salvage sales. However, the Forest is preparing an EIS for this serious outbreak to determine the best method of controlling the situation.

Controlling the mountain pine beetle may require direct chemical treatment, timber harvest, timber stand improvement or a combination of these. While the short-term objective is to reduce beetle populations and tree mortality, the ultimate goal is to create a mosaic of tree age and size classes and to increase species diversity

Dwarf mistletoe continues to be a problem, predominantly in lodgepole pine but to a lesser degree in ponderosa pine. Dwarf mistletoe in lodgepole pine is being reduced by removal of the infested trees through management activities such as timber stand improvement, timber sales, and destruction of unmerchantable infected stands Where necessary, stands are regenerated using either natural or artificial reforestation methods. These practices will continue throughout the planning period.

The Forest's timber management program in past years has not been conducted at a level that would insure the harvest of enough mature timber to maintain healthy, vigorous stands. As a result, many areas on the Forest are susceptible to epidemic insect populations. A large portion of the vegetation on the Forest is overmature and highly susceptible to insects and disease. Presently, the lodgepole pine stands which became established near the beginning of the twentieth century are the most susceptible.

The predominance of mature timber stands on the Forest provides conditions conducive to a number of other diseases such as broom rusts, decaying agents, and cankers. While none of these cause unacceptable losses Forest-wide, they have a significant impact in sensitive areas such as ski areas and campgrounds.

An EIS is currently being prepared by the Forest in relation to the serious outbreak of the mountain pine beetle on the south end of the Uncompaghre Plateau

WILDFIRE

Natural fuels are reaching excessive levels in locations scattered throughout the Forest as a result of mortality due to root and stem rots, insects, diseases, blowdown, and suppression of naturally-occurring fire. Fuel levels in stands managed for timber production are high after logging until such sale activities as fuelwood removal, site preparation (piling, crushing, burning), and slash disposal (burning of landing residues) are completed. In the long term, however, managed timber stands have a lower fuel buildup than natural stands. Fuel build-up along roads is also low since firewood gatherers routinely remove dead timber within 200 feet of either side of a road. Approximately 10% (210,000 acres) of the Forest's timber lands (2,094,093 acres) have been logged in the past, and another 6% (125,450 acres) of the Forest's timber lands are along roads This leaves the remaining 84% (1,760,000 acres) in a natural fuels condition.

Fire occurrence on the Forest is cyclic in nature due to drought cycles. The years 1982 to 1987 had relatively high moisture levels and a low number of acres burned The years 1988 to 1990 were drought years during which the Western United States and this Forest experienced a high number of acres burned.

Generally, during drought years natural fuels present a high fire hazard and create a high probability of having fires larger than 1,000 acres on the Forest.

ECONOMIC SETTING

EMPLOYMENT AND INCOME

The information presented here supplements the FEIS, Chapter III, pages III-9 through III-23

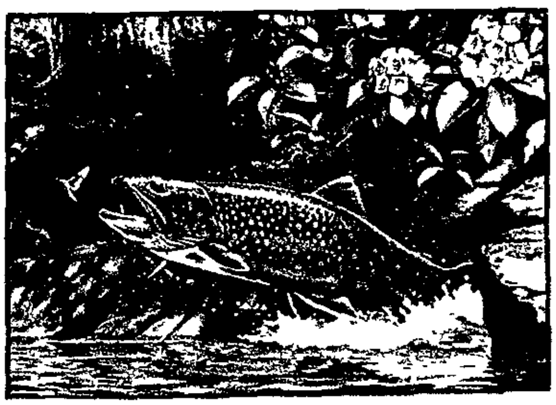
Unemployment in Economic Impact Areas 214 (western half of the Forest) and 215 (eastern half) has increased since the original analysis. Table III-14 compares the unemployment rates by Economic Impact Area for the FEIS and the Forest Plan Amendment Process.

TABLE III-14

WORK FORCE UNEMPLOYMENT RATE (%) WITHIN ECONOMIC IMPACT AREAS (EIA's)

	EIA 214	EIA 215
FEIS (1983)	4.8	3 9
FSEIS (1990)	8 6	5.7

Unemployment in the first eight months of 1988 was high in all of the counties in Economic Impact Area 214. Unemployment ranged from 5.9% in Mesa County to 11.3% in Ouray County. Montrose County averaged 7 9%, Delta County averaged 8.8%, and San Miguel averaged 9.2%. These high unemployment rates are due in part to depressed uranium prices, mine closings, depressed agriculture, and the decline in oil shale processing. The unemployment rates have increased to the point that Delta, Mesa (including the City of Grand Junction), Montrose, Ouray, San Miguel, and Gunnison counties are now designated as labor surplus areas. (above the Colorado statewide average of 4.2%)



IV. Environmental Consequences

IV. ENVIRONMENTAL CONSEQUENCES

TABLE OF CONTENTS

FIGURES

TABLES

CHAPTER IV

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter presents the environmental consequences which would occur if changes were made to the current timber management aspects of the Forest Plan The preceding chapter describes each of the affected resources, while this chapter describes the effects of timber management to these resources It provides the information that is the basis for comparison of the alternatives presented in Chapter II.

Environmental consequences (or effects or impacts) occur when ecosystems are changed, whether through management action or inaction Under each alternative, we would manage the forested lands in a different way In this chapter, we present the known environmental consequences of those different management alternatives.

This chapter is organized by environmental components such as "soils," "wildlife," and "social and economic effects " Each section starts by describing how the proposed management actions would affect the environmental component and what kinds of effects would be considered "significant " Next, direct environmental effects are discussed, along with the reasons they would occur. Changes in one part of the environment often lead to changes in other environmental components. These are indirect effects and are also presented.

Small changes happening repeatedly in the same place over time, or in a number of different places, may have a large cumulative effect These cumulative effects, or their absence, are discussed in a separate section Where impacts would conflict with the plans and policies of other agencies, those conflicts are also presented.

All the alternatives specify ways to avoid, reduce, minimize, and rectify potential adverse effects. These are called "mitigation measures " In estimating environmental effects, these mitigating measures are assumed to be in place Where appropriate, the different sections indicate known experience with these mitigation measures, their dependability, and the consequences that would result should they fail.

The environmental impact statement which accompanied the Forest Plan presented the environmental consequences of all the actions needed to implement the Forest Plan Many actions proposed in the Forest Plan remain unaffected by the changes proposed for timber management. For example, the alternative timber management programs will not affect wilderness designations, campground construction and maintenance, range management programs, and minerals management Because the actions needed to implement the alternatives are limited primarily to road-building and cutting and hauling of trees on forested lands, the environmental consequences of the alternatives are relatively limited in extent, scope, and duration Changes made in the timber management program will not affect all the lands and resources on the Forest

Site-Specific Effects

Each alternative vegetation management/timber management program involves many site-specific projects across the Grand Mesa, Uncompahgre and Gunnison National Forests that would take place over several years. The environmental consequences of each of these site-specific projects would be different, depending on the characteristics of the land; the vegetation and the animals on that site; the weather and time of year; and the way in which the activity is conducted.

In this supplemental environmental impact statement, the environmental effects are generally presented as "Forest-wide effects", with special attention given to effects which vary predictably by the number of acres treated.

Forest Service practice is to perform a site-specific environmental analysis of each proposed project intended to implement the Forest plan before these site-specific projects are carried out. (40 CFR 1950.) These analyses are documented in appropriate NEPA (National Environmental Policy Act) documents. These include an Environmental Impact Statement (EIS), an Environmental Assessment (EA), or, in the case of a categorical exclusion, a Decision Memo. Through this two-step decision process, the environmental consequences at both the programmatic (Forest Plan) level and the site specific (project) level are considered before any action is taken.

How the Effects Were Estimated

In most cases environmental consequences are identified and estimated based on professional experience and judgement and/or research results. Where conflicts in research results are identified, the differences are noted A few of the consequences are based on interdisciplinary team experience, or best judgement in cases where specific expertise was not readily available.

ENVIRONMENTAL EFFECTS

Implementation of the alternatives is not likely to affect the geologic material, topography, or the geomorphic processes taking place on a massive scale. Some alternatives, such as Alternative 1E which would allow harvesting and associated road building of 820 acres per year on steep slopes would increase the risk of accelerating the slope movement process. Also, Alternative 1H would create r additional risk since 80 acres of harvest or road building would occur on steep slopes. However, through planning and design, extremely sensitive areas would be avoided and potential damage would be minimized in Alternatives 1A, 1C, 1D, and 1G.

BIOLOGICAL DIVERSITY

Effects on Genetic Diversity

The alternatives would not have a significant effect on genetic diversity All alternatives use natural regeneration as a standard way to reforest timber stands after a timber harvest. Planting trees would be done only where natural regeneration methods would not work. Timber harvests in riparian areas would be the exception and not the rule. A large scale reduction in genetic diversity would not occur and genetic diversity would not be significantly affected

Effects on Species Diversity

Timber harvesting in spruce-fir favors englemann spruce over subalpine fir and so reduces species diversity, even though subalpine would not be eliminated from stands managed for timber production because it is a prolific seeder *compared to englemann spruce*

A general measure of the reduction in subalpine fir species diversity associated with spruce-fir timber harvesting is the number of spruce-fir acres managed for timber production by alternative. Over the 150 year planning horizon, both subalpine fir and the plants and animals dependent on subalpine fir would be less plentiful than they are today. Table 1 ranks the alternatives from least to greatest decrease in subalpine fir species diversity.

TABLE IV-1

SPRUCE-FIR SPECIES DIVERSITY

Alternative	Spruce-Fir Acres Managed For Timber Production	Percent of Total Forest Spruce-Fir Acres
1D	128,135	14.9%
1G	216,717	25.1%
1H	216,717	25 1%
1C	255,899	29 7%
1A	274,807	31.9%
1E	419,864	48.7%

Alternative 1D would effect subalpine fir diversity the least and 1E the most. Alternatives 1G, 1H, 1C and 1A all would have approximately the same intermediate effect on subalpine fir diversity. In all of the alternatives old growth would be concentrated in the unmanaged spruce-fir stands on the Forest. Even under the most aggressive timber harvesting alternative, one-half the spruce-fir on the Forest would remain in unmanaged timber stands.

Timber harvesting can have either a positive or negative effect on wildlife species diversity. When harvests are made in large blocks of mature timber stands that cover an entire watershed, new kinds of communities are created and wildlife diversity increases as a result.

At the same time that spruce-fir harvesting reduces subalpine fir diversity, it increases general wildlife species diversity by generating a variety of spruce-fir age classes across the Forest. Table 1 indicates that Alternative 1E would provide the greatest increase in wildlife species diversity, and Alternative 1D would provide the smallest increase Alternatives 1G, 1H, 1C, and 1A would have an intermediate effect on wildlife species diversity.

Many large, mature, even-aged blocks of lodgepole pine now exist on the Forest; timber harvesting would increase species diversity in these stands. Table 2 presents the long-term effects on species diversity. This table compares the total acres of lodgepole pine that would be placed under timber management by each alternative and the percent of all lodgepole pine that would be logged on the Forest by alternative Higher harvest levels generally create increased wildlife species diversity as long as a sizable proportion of unmanaged lodgepole pine remains on the Forest

TABLE IV-2

INCREASES IN WILDLIFE SPECIES DIVERSITY FROM LODGEPOLE PINE HARVESTS

Alternative	Lodgepole Pine Acres Managed For Timber Production	Percent of Total Forest Lodgepole Pine Acres
1D	20,389	6 4%
1C	30,906	9.7%
1A	52,354	16.5%
1G	89,366	28.2%
1H	89,366	28 2%
1E	100,244	31.6%

Lodgepole pine stands would provide the least wildlife species diversity under Alternative 1D and the greatest under Alternative 1E. Alternative 1E would harvest about one-third of the Forest's lodgepole pine. Old growth values would be concentrated in unmanaged lodgepole stands in all the alternatives. Alternative 1C also provides a relatively low level of wildlife species diversity. Alternative 1A provides an intermediate level. Alternatives 1G and 1H provide relatively high levels of wildlife species diversity since total harvests would include one-third of the Forest's lodgepole during the next 150 years

Clearcutting aspen can have positive effects on wildlife species diversity in aspen stands. As long as the stand is maintained as aspen, long-term wildlife species diversity will be relatively high compared to other timber types The abundance of aspen on the Forest is decreasing since roughly 25% of the aspen stands are being taken over by conifers. The number of acres of aspen under timber management for each alternative provides a comparison of the level of aspen sustained by each alternative. Table 3 compares total aspen acres harvested and the percentage of all Forest aspen acres harvested by alternative

TABLE IV-3

MAINTENANCE OF ASPEN WILDLIFE SPECIES DIVERSITY

Alternative	Aspen Acres Managed For Timber Production	Percent of Total Forest Aspen Acres
1C	281	0.0%
1A	25,972	4 9%
1D	36,733	6 9%
1G	169,318	31 9%
1H	241,153	45 5%
1E	284,534	53 6%

Alternatives 1C, 1A, and 1D would provide relatively low levels of aspen wildlife species diversity Alternative 1G would manage about one-third of the Forest's aspen and provides a moderate level of aspen maintenance. Alternatives 1H and 1E create relatively high levels of aspen maintenance None of the timber management alternatives would maintain aspen on the Forest at present levels without the aid of wildfire, disease, or large-scale noncommercial aspen treatments Even Alternative 1E would, at most, effect one-half the conifer-invaded aspen on the Forest.

Old growth in ponderosa pine is rare on the Forest as a result of both timber harvesting and mountain pine beetle epidemics Additional harvests would reduce wildlife species diversity, but could increase resistance to future mountain pine beetle epidemics No timber harvesting could mean greater reductions in wildlife species diversity than timber management would create. Table 4 compares the level of ponderosa pine harvested by alternative and the percent of all acres of Ponderosa pine harvested on the Forest.

TABLE IV-4

PONDEROSA PINE MANAGEMENT

Alternative	Ponderosa Pine Acres Managed For Timber Production	Percent of Total Forest Ponderosa Pine Acres
1C	796	0.7%
1A	9,365	8.2%
1D	14,946	13.0%
1G	74,730	65.2%
1H	74,730	65.2%
1E	76,481	66.7%

The alternatives present two different methods of maintaining wildlife species diversity through old growth retention in ponderosa pine. The first method calls for very little management and assumes that the mountain pine beetle would cause fewer reductions in diversity than timber harvesting. The second method calls for a high level of timber management and assumes that timber harvesting would cause fewer reductions in diversity than the mountain pine beetle would. Alternatives 1C, 1A, and 1D favor the "do very little" approach while alternatives 1G, 1H, and 1E favor the "high level of timber" approach.

Without proper road closures the overall wildlife diversity of many species --- especially those which are intolerant of human activity --- would decrease in all these forested habitats

Effects on Community Diversity

The alternatives would enhance community diversity in aspen, lodgepole pine, and spruce-fir through timber management. All of the alternatives maintain a significant portion of the three timber types in an unmanaged condition where old growth would be emphasized; therefore, old growth communities would be preserved at the 5% level A higher level of timber management would create greater community diversity (See Tables 1, 2, and 3 above) since a greater mosaic of age classes would be maintained.

Old growth Ponderosa pine communities are rare on the Forest, and have generally been logged or killed by the mountain pine beetle. The two methods of maintaining ponderosa pine wildlife species diversity discussed above also apply to maintaining ponderosa pine community diversity Neither method is known to be the best way of maintaining diversity on the Forest.

Logging would not occur in the "10A" or "10C" management prescriptions which identify unique ecosystems. None of the alternatives would affect these areas.

FOREST VEGETATION

How Timber Management Affects Forest Vegetation

Plant diversity is an environmental component as well as an important attribute of the Forest Therefore, the discussion of the effects of timber management on plant diversity has been combined, in part, with the effects of the program on the timber resource. Other elements of biodiversity, along with some necessarily repetitive discussions of plant diversity, are discussed in this Chapter (IV) under the heading of "Biodiversity."

Forest management activities can affect the species composition, density, vertical structure, health, vigor (growth), yield, and age of the Forest. Activities such as timber harvesting often have obvious effects on forests; however, other management activities may not be so evident The effects of the alternatives due to timber management activities are often directly tied to the number of acres on which the activities take place This section will discuss the effects of Forest management activities on diversity in both aspen and conifer forests

The Effects --- Aspen

To provide for a diversity vegetative communities, treatments in the aspen type usually are needed to maintain a mosaic of plant communities and age classes The same management technique can be used to provide both interspersion and edge communities and to enhance boundary length between the aspen communities that make up the mosaic (Debyle and Winokur, 1985).

Clearcutting would reduce vertical diversity in a particular aspen stand to zero, diversity would, however, increase over time. Within the first decade, those alternatives which treat the most aspen would decrease vertical diversity the most The opposite can also be assumed to be true. However, the juxtuposition of stands in various stages of vertical diversity would be greater among the alternatives that log the most aspen.

Considering the current condition of aspen on the Forest, those alternatives which call for cutting more aspen would also provide a higher degree of horizontal diversity. Without treatment or such naturally occurring catastrophic events as fire, the non-self regenerating aspen stands would cycle through natural succession and eventually be replaced by the climax vegetation stage associated with any site. This would tend to create more homogenous vegetative conditions with a corresponding decrease in horizontal diversity.

Figure IV-1 provides an indication of which alternatives would affect horizontal diversity the most within the aspen type The more evenly the three age classes are distributed throughout the aspen type, the higher the probability that horizontal diversity would increase Those alternatives that exhibit a larger percentage of acres in any one age class would provide the least horizontal diversity

Table IV-5 ranks the alternatives according to these assumptions, and gives an indication of which alternatives would have the potential to most strongly affect vertical and horizontal diversity

TABLE IV-5

EFFECT OF ALTERNATIVES ON DIVERSITY

	Alternatives					
	1A	1C	1D	1E	1G	1H
Vertical Diversity*	3	1	2	6	4	5
Horizontal Diversity**	5	6	4	1	3	2

* 1 - Least decrease; 6 - Most decrease
** 1 - Most increase, 6 - Least decrease

The Effects - Conifer

Table IV-6 displays the amount of affected acres for all types of management as well as the number of acres treated by alternative for each timber type and method of treatment Those activities associated with even-aged management activities contribute more to horizontal diversity while uneven-aged management activities contribute more to vertical diversity. As time proceeds and more activities are completed, the Forest would assume a patchwork structure of managed stands interspersed with natural and logged areas The effect on diversity would be most noticeable as natural areas are entered that have not been previously logged As these areas are entered,even-aged management activities would contribute to horizontal diversity, i e the diversity of tree and understory vegetation age classes would increase across the Forest. These activities would generally decrease vertical diversity depending on the natural growing characteristics of the particular plant type Uneven-aged management activities do not contribute significantly to horizontal diversity, and, although they may decrease vertical diversity at first, the long term effect would be to show an increase in vertical diversity

TABLE IV-6

AVERAGE ANNUAL ACRES HARVESTED BY SPECIES AND METHOD
(First Decade)

	Alternatives					
Species/Method	1A	1C	1D	1E	1G	1H
Clearcut						
Aspen	310	0	489	2,797	1,376	2,006
Lodgepole Pine	1,186	0	0	733	733	733
TOTAL	1,496	0	489	3,530	2,109	2,739
Shelterwood						
Spruce-fir	6,600	6,091	0	7,308	4,551	4,551
Ponderosa Pine	486	0	0	667	667	667
TOTAL	7,086	6,091	0	7,975	5,218	5,218
Selection						
Spruce-fir	0	0	3,092	0	0	0
TOTAL ALL SPECIES	8,582	6,091	3,581	11,505	7,327	7,957

Those alternatives which harvest more lodgepole pine and ponderosa pine through even-aged management would increase horizontal diversity the most. Vertical diversity would not be significantly affected due to the lack of natural vertical diversity these timber types exhibit on the Forest. Uneven-aged management within these timber types is generally not practiced Figures IV-2 and IV-3 provide an indication of how lodgepole and ponderosa contributes to horizontal diversity (These figures should not be used as an indication of vertical diversity.). Those alternatives which harvest spruce-fir under even-aged management would decrease vertical diversity the most, but would increase horizontal diversity the most The opposite is assumed to be true for uneven-aged management Figure IV-4 provides an indication of how each alternative contributes to horizontal diversity in spruce/fir (This figure should not be used as an indicator of vertical diversity). Alternatives which have the highest percentage of acres in one age class would provide the least horizontal diversity while those with a more evenly distributed number of acres in each age class would provide the most.

Need For Mitigation - Aspen and Conifer

All management activities must be designed to meet minimum plant diversity standards These standards assure vegetative stability as well as a wide array of structural stages on the Forest These are necessary to meet the needs of a variety of wildlife speces. Some of these standards include·

- Maintain or create a minimum of 20% vertical diversity within a diversity unit.
- Maintain or create a minimum of 30% horizontal diversity within a diversity unit.
- Provide a Patton edge index of 1.4 and at least a medium edge contrast.

The Effects --- Old Growth

Any alternative which harvests the mature to over-mature timber stands would result in a decrease in the amount of old growth habitat on the Forest. Figures IV-1 through IV-4 display by alternative and timber type the number of acres treated in the older (91+) age classes at decades 5 and 10. The alternatives which have the smallest number of acres to decade 5 and 10 in the 91+ age class would decrease old growth habitat the most. The opposite would also be true.

Need For Mitigation --- Old Growth

All management activities must be designed to meet certain minimum old growth standards in order to assure that adequate habitat exists to maintain viable populations of all existing vertebrate wildlife species on the Forest. In forested areas of a diversity unit, at least five percent must be in old growth habitat. This old growth must occur in thirty acres or larger, irregular patches. At the project level, and whenever possible, the Rocky Mountain Old Growth Scorecard will be used to identify the biological old growth characteristics of these stands in order to make sure that the characteristics old-growth-dependent wildlife species need are provided.

All of the alternatives which harvest older timber stands would decrease old growth habitat in the short term However, as unharvested stands continued to grow, old growth characteristics would increase. On the Forest as a whole no alternative would decrease old growth habitat below the level needed to maintain viable populations of those species which depend on old growth. There would be localized decreases of habitat and displacements of these species where harvest does occur. The biological characteristics of these stands on the entire Forest will continue to be inventoried as time, personnel, and funding are available.

Cumulative Impacts

A variety of areas on the Forest are managed to provide for natural or near natural forest conditions while emphasizing different resource values. Where human-induced changes are kept to a minimum, natural or near natural conditions will continue. These areas slowly progress to climax forest conditions. In general, natural or near natural conditions would dominate the Forest for all alternatives, but some differences would exist between the alternatives in terms of the acres on which natural succession prevails.

As time proceeds, the lands suited for timber production would assume the structure of managed stands with interspersed unharvested areas. As natural stands are altered by timber harvest, the diversity of tree and understory vegetation age classes would increase in certain watersheds, although the diversity on specific sites would decrease.

TIMBER

A principle effect of timber harvest is to capture the tree growth, yield and economic benefits of the Forest. Timber harvest and related activities provide the opportunity to increase long-term productivity gains on the future forest Timber activities are designed to provide a continuous supply of trees and wood products from the Forest. Chapter II presents a discussion of yield and other economic benefits.

The alternatives vary in the number of acres of each species treated by different silvicultural methods. The type of harvest method, its timing over the planning horizon, and the number of acres treated all affect age class distribution. Age class distribution is an important indicator of habitat conditions over time and reveals broad, long-term changes that would occur Table IV-6 (page IV-**22**) displays the effects of the alternatives in relation to acres treated, species treated, and the silvicultural method used

Even-aged regeneration

Regeneration harvest is the removal of all or a portion of a tree stand on the Forest in order to establish a new stand. Even-aged regeneration cutting, as practiced on the GMUG National Forests, is mainly shelterwood and clearcut regeneration harvest Overstory removal where advanced regeneration is present in sufficient size and abundance is also an important harvest method during the early decades of the Plan. In a clearcut harvest all of the trees are cut in one operation. In shelterwood cutting, the trees are logged in two, three, or four operations The first two cuts (preparatory and seed cut) remove 50-60 percent of the standing trees and prepare the site for natural regeneration The final cut takes place one to two decades later when reproduction has been established Typical spruce-fir stands on the Forest contain a component of natural regeneration ranging from ten to 40 years in age at the time of the first cut in a stand. The first and succeeding harvest cuts create growing space and reduce nutrient competition for this "advanced regeneration," thus resulting in an acceleration of growth rate in the stand.

Regeneration cutting promotes the establishment of new stands of trees It provides growing space and reduces competition for sunlight, water, and nutrients. The structural diversity and age class distribution in specific stands could be reduced by regeneration harvest, but the diversity of the Forest could be increased by the patchwork of created, even-aged stands, particularly where large expanses of unbroken cover in the same mature structural stage exist Treatment of vegetation in such cases through even-aged management techniques makes it possible to maintain and perhaps increase the variability of forest stands as they become more horizontally diverse.

Vegetation changes tend to be most rapid after clearcutting (Cleary and others 1978) Since moderating the amount of sunlight reaching the ground is one objective of shelterwood cutting, changes in understory vegetation can be expected to be less dramatic for shelterwood cuts than for clearcuts The amount of transitory domestic livestock range produced by harvesting decreases as the amount of remaining overstory increases (Hendrick and others 1968)

The degree to which the above identified effects are exhibited is proportional to the number of even-aged harvest acres. In all alternatives, clearcutting is used mainly for aspen

Uneven-Aged Regeneration

Uneven-aged regeneration is begun by either individual tree selection or group selection logging methods. Logging promotes regeneration by removing trees, providing growing space, and reducing competition for light, water, and nutrients, but in a lesser degree than with even-aged cuts Uneven-aged cuts generally affect a larger area with more frequent entries than even-aged cuts Fewer trees per acre are cut on each entry with smaller environmental effects per entry.

Cleary and others (1978) state, "Cuts under the selection method are usually light enough so that they maintain an environment that is similar to that of an undisturbed stand." Transitory range would be produced, but at a lower level than with even-aged management (Hedrick and others 1968).

Individual tree selection would have minimal effects on the age-class diversity of trees in uneven-aged stands. The reduction in diversity of age classes would be greater for group selection although, as Cleary and others (1978) state, "....the intent of group selection is to create a balance of age or size classes either in intimate mixture, or in a mosaic of small contiguous groups throughout the forest."

The species composition of the existing stand and the method in which it is harvested determine the extent of changes in species diversity. The opening created by either individual or group selection harvest methods is often so small that only the most shade-tolerant species of late successional stages can be maintained (ibid) Therefore, if uneven-aged regeneration is practiced in stands of associated species, the species diversity would be reduced or stabilized and the species composition would shift toward subalpine fir and away from Douglas fir in mixed conifer sites. Species composition should be roughly similar in spruce-fir sites Because of the prolific regeneration of subalpine fir, the shift in species composition should be toward more fir as a result of uneven-aged management

The alternatives vary in how many acres of each species are treated by differing silvicultural methods. The type of harvest method, its timing over the planning horizon and the number of acres cut, all affect age class distribution Age class distribution is an important indicator of habitat conditions over time and reveals broad, long-term changes that would occur. Table IV-6 (page IV-9) displays the *effects of the alternatives in relation to acres treated, species treated and the* silvicultural method used.

Timber stands, if not altered by logging, fires, or other planned or unplanned influences, would continue to increase in age. Wildlife species dependent on older, mature forests would benefit, while those requiring younger age classes would not. Big game hiding and thermal cover would increase but available forage would decrease The diversity of plant and animal species and visual resources would decrease Timber and water productivity would decrease as the trees continued to mature and began competing with each other for available water and nutrients Primitive and semi-primitive recreation opportunities would increase in both quantity and quality as the forest took on a mature character and the influences of man's activities disappeared Motorized recreation opportunities would decrease

The differences between the acres treated by alternative create different age classes and different increases in diversity. In the alternatives, lodgepole pine and aspen are treated only by clearcutting. Ponderosa pine is treated only by shelterwood harvesting. Spruce-fir is treated with selection harvesting in Alternative 1D and by shelterwood harvesting in the other alternatives Clearcutting would have the greatest effect on diversity followed by shelterwood harvesting and, finally, by selection harvesting Table IV-6, page IV-9, lists acres harvested by method The alternatives, ranked by changes in diversity from high to low, are as follows:

Alternative 1E	Relatively High Increase In Diversity
Alternative 1H	|
Alternative 1G	|
Alternative 1A	|
Alternative 1C	|
Alternative 1D	Relatively Low Increase In Diversity

Figures IV-1 through IV-4 display, by alternative, the age classes for each species as they currently exist, after 50 years, and after 100 years. They portray how the various harvest levels by silvicultural method would alter the age class distribution across the Forest These alternatives that schedule the most timber volume bring about a change to a younger and more diverse age class distribution sooner than those alternatives with lower volumes.

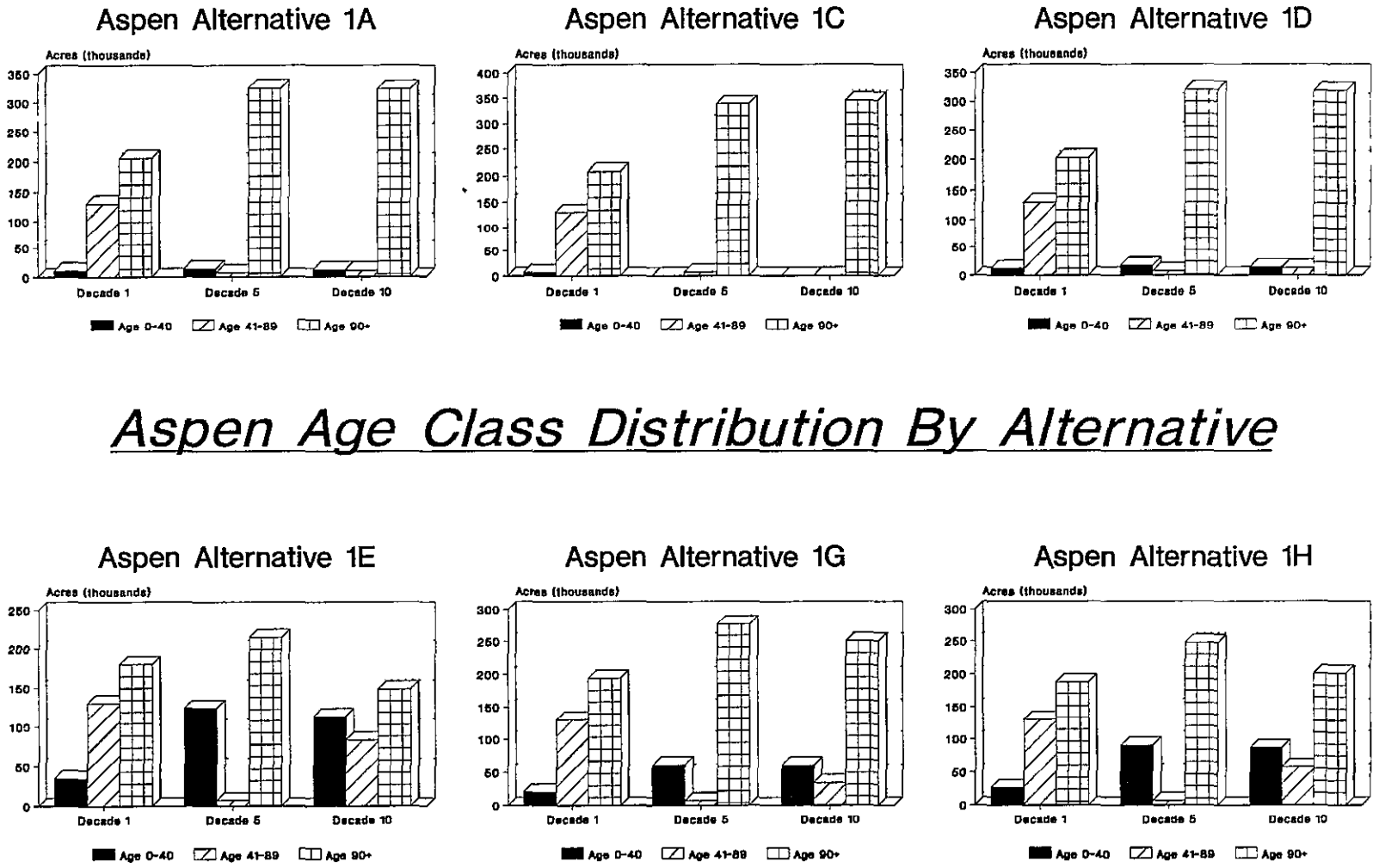
Figure IV-1 (aspen) shows that Alternative 1E brings about a managed condition with a higher even-age class distribution Alternatives 1G and 1H provide an intermediate age class distribution between even-age classes on the best stands on the Forest and old growth in the more-costly, less-productive stands on the Forest Alternatives 1A, 1C, and 1D, provide the greatest percentage of old growth.

Figure IV-2 (lodgepole pine) shows that in Alternatives 1D and 1C few stands are treated and therefore many would be mature by the fifth decade. This would creat an increase in insect, disease, and fire potential Alternative 1A provides an intermediate level of treatment. Alternatives 1G, 1H, and 1E bring about a managed condition with a more even age distribution

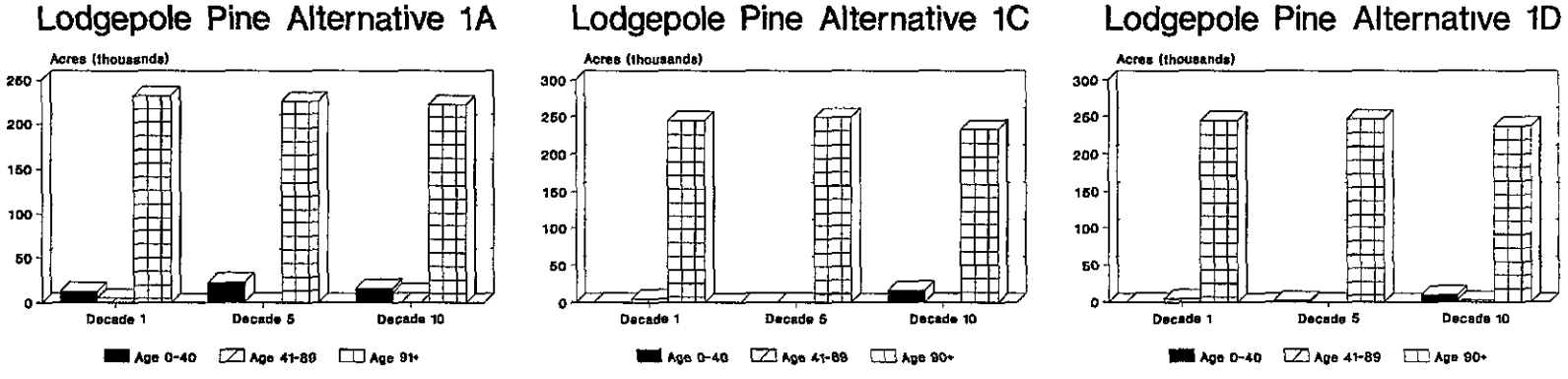
Figure IV-3 (ponderosa pine) shows the lack of treatment in Alternative 1C and the 100% mature condition of ponderosa pine by the tenth decade Alternatives 1A and 1D provide a moderate level of treatment with a majority of pine stands reaching maturity by the tenth decade. Alternatives 1E, 1G, and 1H bring about a more even distribution.

Figure IV-4 (spruce-fir) shows that Alternative 1D has the least effect on decreasing the number of acres of mature spruce-fir over time while Alternative 1E brings about the more even age distribution. Alternatives 1A, 1C, 1G, and 1H have an intermediate effect

Figure IV-1



Aspen Age Class Distribution By Alternative



Lodgepole Pine

Age Class Distribution By Alternative

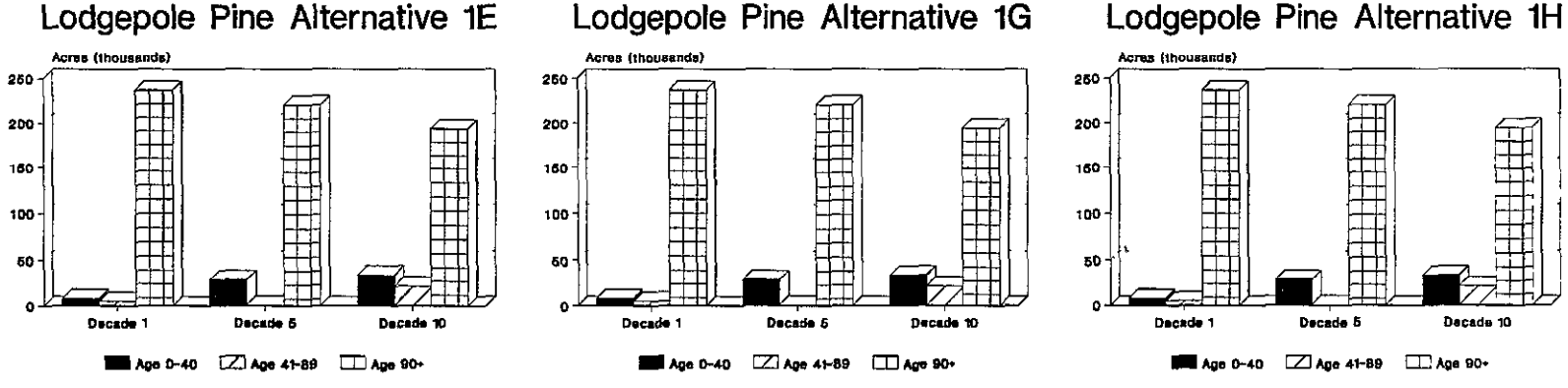
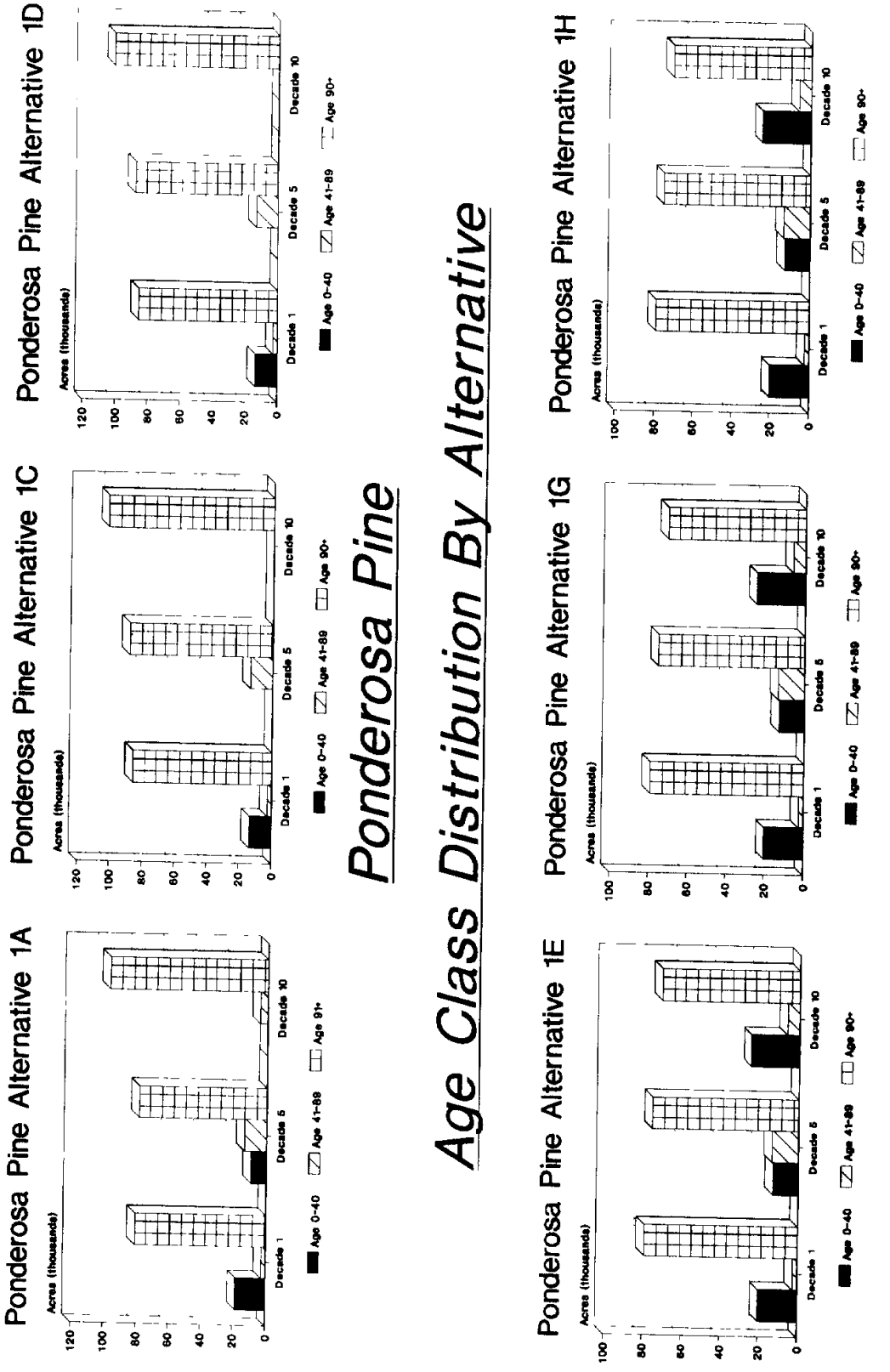
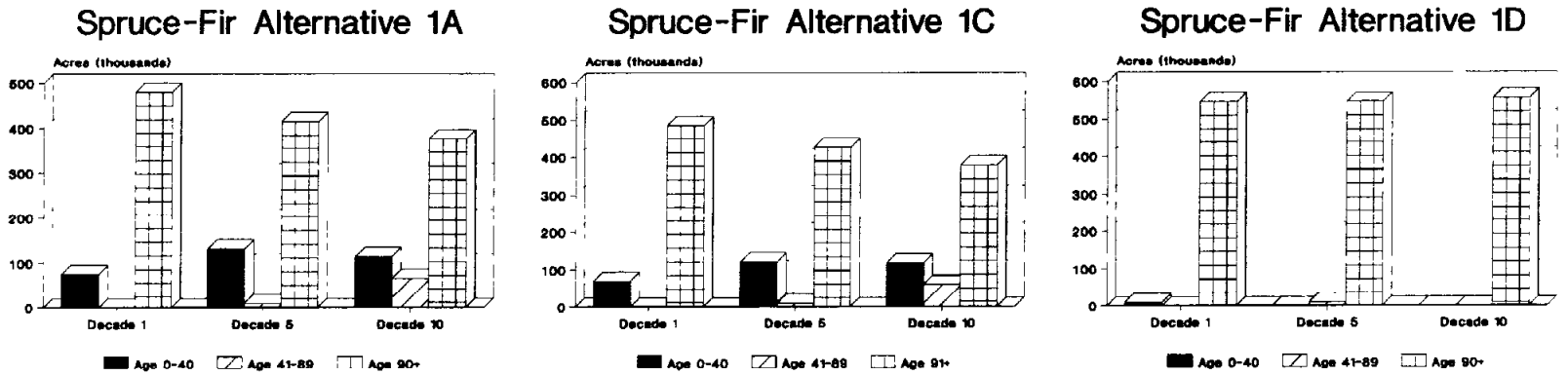
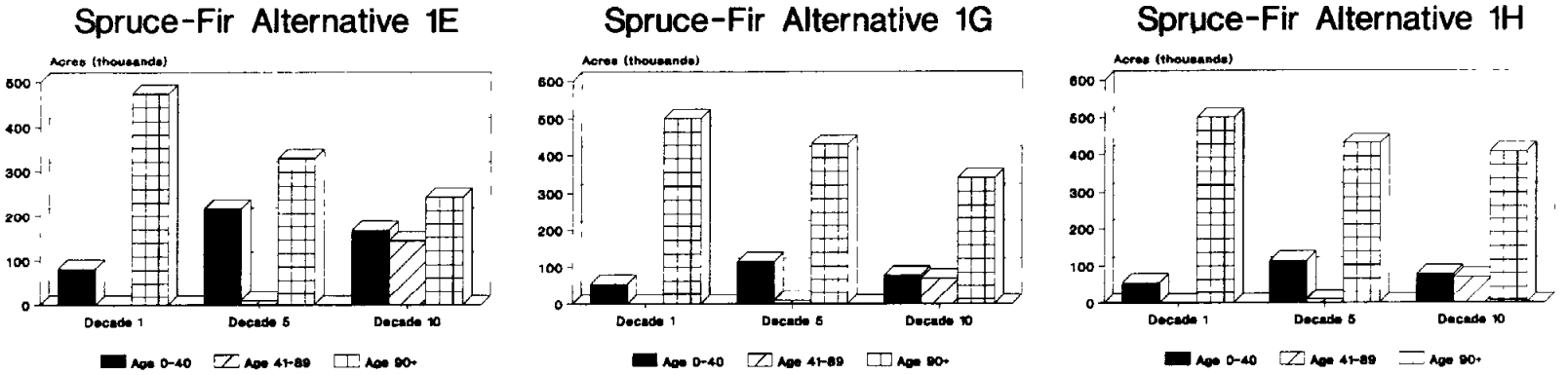


Figure IV-3


Ponderosa Pine
Age Class Distribution By Alternative
Ponderosa Pine Alternative 1A
Ponderosa Pine Alternative 1C
Ponderosa Pine Alternative 1D
Ponderosa Pine Alternative 1E
Ponderosa Pine Alternative 1G
Ponderosa Pine Alternative 1H
Acres (thousands)
Decade 1
Decade 5
Decade 10
Age 0-40
Age 41-89
Age 90+
Age 91+



Spruce-Fir Age Class Distribution By Alternative



CLIMATE

Scientists now think that removal of large areas of forest vegetation can have an effect on the oxygen/carbon dioxide balance, on local climate, and even on global climate. None of the alternatives considered in this EIS call for harvesting trees on anywhere near that scale. Forests in the northern latitudes may play an important role in absorbing carbon dioxide, although they are not as significant in this role as equatorial forests. However, it is not yet known whether northern latitude forests can play a role in stabilizing world carbon cycles, nor is there any firm scientific idea as to what that role might be Forests on the Grand Mesa, Uncompahgre and Gunnison National Forest are high-elevation forests that grow relatively slowly The stands of trees on this Forest are likely to absorb small, but measureable, amounts of carbon dioxide and carbon-based gasses; however, it seems likely that understory vegetation here contributes little to carbon absorption.

The continued health and growth of existing forests is important to this nation's efforts to stabilize global climate change. The modern silvicultural and vegetation management practices provided for in the standards and guidelines for all of the alternatives are designed to simulate natural events in the GMUG as closely as possible. The management practices are no greater in scale, timing, area, or duration than typical forest events such as insect attacks, the course of disease in stands, naturally caused wildfire, or the normal pattern of decay in spruce-fir stands which have reached the end of their life spans These events are important to the regeneration of spruce-fir and aspen stands in an unmanaged state, and they are important to biological diversity, stability, and resistance to catastrophic events. The continuous regeneration and regrowth of timber stands cut over time would result in no net effect in terms of oxygen/carbon dioxide balance, the overall climate of the area, or global warming.

Well-designed management practices can be used to perpetuate spruce-fir and aspen stands by increasing the health and vigor of individual stands through thinning that allows the remaining trees to have greater access to limited nutrients and water. This, in turn, improves the ability of each stand to ward off disabling events such as those described above. Through the use of shelterwood cuts, spruce-fir stands are being perpetuated. Natural processes of decay in undisturbed spruce-fir stands last for 50-60 years, and an equal amount of time is often required before the regeneration process fully takes hold We are attempting to perpetuate these spruce-fir stands instead of permitting them to decay.

The diversity of stands and species can be improved by regenerating and retaining the existing aspen stands within a coniferous area and by creating a mosaic of different age classes among conifer stands. Such diversity would increase the general resilience of the forests under any of the alternatives

Small changes in microclimates in timber harvest areas may occur These effects would be the consequence of differences in snow accumulation and melting, solar insolation and radiation, and wind protection brought about by the removal of all, or parts, of timber stands. Potential effects include delayed snow melt resulting in prolonged wetness during the spring snowmelt period followed by dryer conditions in the late summer and fall. These effects are no different than those which would be caused by the natural disturbances which have been recurrent throughout the natural history of the area These changes are so small that they would require sophisticated techniques to even be measured. The level of accuracy of any prediction or measurement of microclimate would be insufficient to detect any differences which might exist among alternatives Even to suggest that alternatives with higher harvest levels would have more effect than those with smaller harvest levels suggests a difference in effects which does not exist. No real difference exists among the alternatives in terms of climate and there would be no significant cumulative effect from microclimate changes on the climate of the forest.

SOILS

How Timber Management Affects Soil Resources

The effects of timber management on the soil resource can include changes in chemical, biological, and physical characteristics. These have been reviewed by Geppert, Lorenz and Larson, 1984 and Stone, 1977 Generally, the chemical and biological effects have only been documented and monitored through research efforts It is generally believed that over time these alterations stabilize, usually with no major impact to overall site productivity (Geppert, Lorenz, and Stone).

The Forest Service has recently attempted to define categories of physical disturbances that have, through research, been found to potentially affect soil productivity The categories include· compaction, displacement, erosion, puddling, severely burned, and inundation of toxic substances (FSH 2509.18 Chapter 2, Soil Quality Monitoring 10/87).

Timber management and related activities can affect the soil resource through heavy equipment operation on the site (logging), road building activities, and transport of the logs from the site. The use of tractors, if not carefully managed, can result in detrimental rutting, compaction, erosion and puddling Disturbing the surface layer and removing organic matter could lead to a reduction in site productivity on shallow or infertile sites

The road building activities often associated with timber management can affect the soil resource. Road construction and reconstruction activities usually require that the soil and rock be exposed, dug, cut through, and reshaped by heavy equipment When the vegetation is removed and bare soil is exposed, the probability of erosion increases. The digging, cutting, and over-all disturbance of road building can change weight distribution relationships on a slope These same activities can change the surface and subsurface flow patterns of water across the land If care is not taken, these actions can result in slumping, slipping, and soil erosion.

Alternative 1E has the most potential to affect the soil resource (1,764 acres cleared and 420 miles of road contruction) while Alternatives 1D (378 acres cleared and 90 miles of road construction) and Alternative 1C (462 acres cleared and 110 miles of road construction) would produce the least impact. Table IV-8 presents the acres cleared and miles of road construction for the alternatives.

Alternatives 1E and 1H could cause a concentration of harvest in certain watersheds, which, in turn, could result in increased erosion and loss of slope stability. Other resources could be affected as well (i e., water and fisheries) Both Alternative 1E and 1H include harvesting on steep slopes The risk of erosion and slope failure would be higher for these alternatives due to harvesting and roading in these steep slope acres.

The proposed Forest alternative, 1G, would reduce conifer harvesting and increase aspen harvesting. The planned aspen harvest is spread throughout the Forest, and no significant impacts are expected on the soil resource. Also, no significant impacts to the soil resource are anticipated for Alternatives 1A, 1C, or 1D if harvesting is dispersed

Clearcutting aspen has minor potential to affect the soil resource because of aspen's quick recovery and revegetation. Increases in aspen harvest present a lower risk of hurting the soil resource than the same amount of acres logged in spruce-fir or lodgepole pine.

The effect that road building and logging have on the soil resources depends on a number of things such as the type of equipment used, the experience and care of the operator, the weather, soil moisture conditions, resilience of the soil, and the amount of coarse fragments left on-site. Research studies, substantiated by local field observations, point out that negative effects can be prevented or kept to a minimum by the careful operation of equipment, the appropriate timing of activities, and the application of mitigating measures to a site as soon as possible.

Specific Effects

Soil Erosion Hazard

Information about erosion potential would be used in the individual design and cost estimates for specific activities The actual amount of erosion that results from timber management activities is difficult to quantify (Heede, 1984; Patric, 1985, Hungerford & Babbitt, 1976). The most potential for erosion exists in the roads and skid trails associated with the logging activity and not necessarily in the action of cutting trees (Stone, 1976; Stednick, 1987; Megahan, 1976). Many studies substantiate the fact that road construction has the potential to cause accelerated erosion on forest lands (Megahan, 1976).

Excessive soil erosion within a road area causes costly maintenance problems If the soil erodes and washes away from a road area, it could become detrimental sediment affecting other resources (i e., water and fisheries) The actual amount of soil that might reach the drainage systems and become harmful sediment would depend on such factors as the location of roads in relation to running water, the degree of slope, the amount of disturbed and undisturbed vegetation, the weather conditions, and the specific soil type

The erosion process itself is very site specific and often soil dislodged from one particular spot is deposited in nearby areas. Heede (1986) found that with prudent timber sale planning and well thought out road locations, overland flow, erosion, and sediment delivery from mixed conifer watersheds in Arizona were insignificant. The study, however, indicated that actual erosion varied in intensity over an area and was not universal. The main sediment sources were disturbed areas, roads, and unstable channels

Johnson (1984) noted, in a Utah study of small aspen clearcuts, that, "because of the method of skidding and location of clearcuts away from permanent stream channels, the clearcuts were not expected to contribute significantly to sediment production"

Actual measurements of sedimentation rates at the Fraser Experimental Forest at Fraser, Colorado have compared erosion rates on silviculturally treated watersheds and adjacent undisturbed watersheds. The Fool Creek drainage was strip clearcut and contained 12 miles of constructed road. The resultant measurements showed a sediment yield of 200 lb/acre (0.1 ton/a) the first few years, sediment yields have since fallen to 43 lb/acre (0 022 ton/acre) The undisturbed paired watershed of East St. Louis Creek had measured rates of 11 to 21 lbs/acre (0 006 - 0.01 tons/acre) during the same time period

The Universal Soil Loss Equation (USLE) has been developed in agricultural areas east of the Mississippi River This is used to estimate soil loss due to different farming practices on different slope and soil conditions Work has been done to make it somewhat usable in forested conditions. When local data was used on recent average timber management activities, the following results were obtained.

TABLE IV-7 - SOIL EROSION ASSOCIATED WITH TIMBER CUTS

Timber Type	Soil Loss
Aspen clear cut	0 13 tons/acre/year (260 Lbs)*
Intermediate spruce cut	0 03 to 0 06 tons/acre/year (60 to 120 Lbs)*

Because of the very quick regeneration response of aspen stands, soil loss rates decline rapidly in this type of stand after the initial disturbance.

While site specific measurements have not been made for the Forest, we do believe, on the basis of general field observations, that these general principles apply on the Forest. The potential for soil erosion and associated sedimentation correlates well with the miles of road and acres cleared shown in Table IV-8

Table IV-8 displays decade 1 local road construction miles by alternative and the estimated amount of acres that would be cleared.

TABLE IV-8

TOTAL LOCAL ROAD CONSTRUCTION DECADE 1
(Does not include reconstruction)

	Alternatives					
	1A	1C	1D	1E	1G	1H
Miles	230	110	90	420	240	280
Acres Cleared	966	462	378	1,764	1,008	1,176

The central concept is that accelerated erosion and damaging sedimentation can be avoided. This is supported by Stednick, 1987; Heede, 1983; Heede, 1986; Megahan, 1977. Adverse impacts would be kept to a minimum as the Standards and Guidelines of the Forest Plan are followed.

Studies have shown that the amount of erosion caused by silvicultural treatments on forest land *may* not be appreciable *if* the cuts are accomplished with the proper planning and careful operation of the heavy equipment used (Stone, 1977; Stednick, 1987)

Soil and Slope Stability

Small slumps and slides may occur as a result of timber management and road building activities Due to the Forest's geologic makeup and physiographic position, there are large areas of unstable slopes Generally, the most unstable areas would be identified and avoided. However, Alternative 1E and 1H would require building roads to acres on steep slopes, and this would create a high risk for slope failures. None of the remaining alternatives require harvesting or road building on steep slopes and, therefore, would have a low risk for slope failure

Soil Productivity

Logging activities could adversely affect long term soil productivity in some locations Wheeled skidders and crawler tractors, used locally for logging, disturb soil over relatively large areas Tractors can cause deep soil disturbances in the form of rutting, displacement, puddling, and compaction. Roads, skid roads, and log landings concentrate these activities Such disturbances, could adversely affect the long term productivity of the land The potential for these negative effects would be in direct proportion to the number of acres of timber harvest called for in an alternative, as displayed in Table IV-8. Alternatives ranked best to worst in terms of potential effects on long term soil productivity are: D,C,A,G,H,E.

The mitigation measures listed under "Need for Mitigation" are designed to reduce or eliminate these potentially negative effects. After using these mitigation measures, no long term reduction in soil productivity would be expected on sites other than those committed to permanent road beds and log landings. While the effects on these areas could be reversed with much effort or could diminish over a very long time, we consider them a commitment of resources just short of irreversible/irretrievable.

Cumulative Effects

The only recognized cumulative effect of timber harvest on soils is the potential for reduction of soil productivity on sites that are repeatedly disturbed. Recurring activity in timber stands may not allow for the natural breakup of compaction or may prevent the soils from revegetating and establishing protective cover. Those alternatives which rely more heavily on silvicultural methods that require periodic re-entry of a stand (shelterwood) as opposed to a single entry harvest method (clearcutting for example) would have the greatest potential to cause these cumulative effects. However, the mitigation practices would effectively maintain soil productivity in all harvest sites

Need for Mitigation

In accordance with the Multiple Use - Sustained Yield Act and other legislation (RPA, NFMA, etc.), National Forest System lands are to be managed for a variety of multiple uses without affecting the long term productivity of the land or degrading water quality Mitigation in the form of soil and water conservation practices is a means to ensure protection of soil productivity and water quality The application of soil and water conservation practices translates, in essence, to good land stewardship

Soil and water protection measures for the various multiple use activities can be found in the Forest Standards and Guidelines, in Chapter III of the Forest Plan Additional measures can be found in the Regional Soil and Water Conservation Handbook.

Protection measures specific to timber management and road building include.

Timber Management -

- Identification of sensitive soils and slope situations through the use of soil survey information, geologic information, or other related hazard-type data

- Avoiding the identified sensitive areas if at all possible If these sensitive areas are impossible to avoid, special measures would be designed and implemented to lessen adverse impacts on the areas.

- Careful planning and layout of the skid trail system in advance of the logging activity. This would take into consideration the road system, landing locations, topography, and sensitive areas. A well planned skid trail system, in theory, would minimize the area of disturbance and provide for a more efficient and less costly operation.

- The creation of log landing and decking areas would be minimized and scarification would be limited

- Setting goals to keep overall disturbance to a minimum and accomplishing this through close administration of contracts and compliance monitoring

- Evaluating soil moisture conditions before and during activities and curtailing the use of heavy equipment during extremely wet situations when soil is most susceptible to damage.

- Using erosion control practices during the activity and immediately after its conclusion, as they are needed to protect all resource values involved

Mitigation for roads may include -

- Careful planning and design to fit the road to the landscape and to fit the road for the anticipated level and season of use.
- Avoiding problem areas such as flood zones, narrow canyon bottoms, wet areas, and highly erodible or unstable soils.
- Locating roads well away from streams, both perennial and intermittent, whenever possible and crossing streams only at right angles.
- Designing appropriate drainage features to prevent water from concentration on either the road surface or unstable fresh soil.
- Keeping the vegetative clearing limits to the absolute minimum needed for the road right-of-way.
- Depositing surplus soil and rock in designated areas where the the runoff would not reach water bodies or streams.
- Maintaining proper inslope, outslope, or crown and reshaping grade dips.
- Using erosion control practices during new construction with follow-up monitoring to assure that the measures work.

The mitigation measures, if properly planned, budgeted, and placed, should effectively prevent any significant adverse effects on soil productivity and stability.

AIR QUALITY

All of the alternatives may temporarily affect local air quality by creating dust and smoke. The dust would result from road construction and logging truck movement over the roads. However, fine particulates resulting from road dust would not have a significant effect on air quality on the Forest or within the region

Smoke would result from slash burning for site preparation and from blurning to reduce fire hazard. Burning would be scheduled to meet weather conditions that would maximize dispersal. Also, slash burning is expected to decline over time due to soil productivity needs and use of forest products

WATER YIELD

How Timber Management Affects Water Yield

This information supplements the discussions of water and sediment yields in Chapter IV of the FEIS Pages IV-66 through IV-77.

Cutting trees in forest stands increases water production. In the transpiration process, trees draw up water through their roots and pass it through their leaves or needles into the atmosphere as water vapor. If trees are cut, water which was previously lost through transpiration becomes available to supply springs, streams, and rivers.