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Department of
Agriculture

FOREST SERVICE

DELTA, COLORADO

FINAL
OIL AND GAS LEASING ENVIRONMENTAL IMPACT STATEMENT

GRAND MESA, UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS

Volume I

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Cooperating Agency
USDI BUREAU OF LAND MANAGEMENT

Final Environmental Impact Statement
Oil and Gas Leasing Analysis

Grand Mesa, Uncompahgre and Gunnison National Forests

Delta, Garfield, Gunnison, Mesa, Montrose, Ouray and San Miguel Counties, in the State of Colorado

April 1993

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Cooperating Agency:	USDI Bureau of Land Management
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Abstract: The Environmental Impact Statement documents the analysis of five alternatives developed for possible management of oil and gas leasing on approximately 1/3 of the 3 million acres administered by the Grand Mesa, Uncompahgre and Gunnison National Forests Supervisor. Portions of the Forests not included in this analysis are areas of no known potential for oil and gas resources and areas of low potential in which the oil and gas industry have shown no interest, to date. Alternatives include: 1) Current management (as specified in the current Forest Plan, 2) leasing approximately 125,980 acres under Standard Lease Terms, 687,200 acres under supplemental stipulations, and discretionarily removing 138,270 acres from leasing, 3) No new leasing Forest-wide, 4) Leasing the entire analysis area under Standard Lease Terms, 5) the same as alternative 2 with the exception that all Roadless Areas and Semi-primitive Non-motorized Areas (3A Management Areas) would be No Lease. The document also discloses the information necessary for the Forest Supervisor to determine those specific lands that will be authorized for leasing. These decisions will be documented in a separate Record of Decision, which will also amend the Forest Plan.

Preface

We want you to read and consider the information presented in this EIS!

This is a complicated Environmental Impact Statement. It contains detailed information about activities and effects associated with the potential leasing and development of oil and gas resources on the Grand Mesa, Uncompahgre and Gunnison National Forests.

The information is organized in the order of the analysis and decision-making process. This analysis and decision-making process is described in Chapter I. **Understanding Chapter I is essential to understanding the rest of the EIS.** Some of Chapter I is background common to any National Forest undertaking an oil and gas *Leasing Analysis*, and some of it is **unique to this Forest and to this EIS**.

To serve as an aid in tracking your position in the document, the "footers", or notes at the bottom of every page, are keyed to major headings of the EIS. These major headings are shown in the Table of Contents at the beginning of the EIS, and at the beginning of each chapter.

Our objective has been to meet the twin aims of NEPA: to disclose and inform. We have disclosed, for public review, the environmental consequences of choices being considered by the decision-maker. By so doing we have informed the public, and most importantly the decision-maker, of the potential consequences of these choices.

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Chapter I - Purpose and Need

Introduction

The purpose of this Final Environmental Impact Statement (FEIS) is to evaluate the potential effects of alternative programs for oil and gas leasing on the Grand Mesa, Uncompahgre and Gunnison National Forests; to amend the Land and Resource Management Plan (Forest Plan) to adequately address availability of lands for oil and gas leasing; to provide direction to implement the leasing decisions; and to give the interested public an opportunity to participate in the process and comment on the proposal. The alternatives range from *No Lease* to *No Action* to *Lease with Standard Lease Terms* (see Chapter II - Alternatives).

Oil and natural gas are important resources for the people of the United States. They are the primary sources of energy for most mechanical equipment, lighting, heating, transportation, communications, and agriculture. Petroleum products are important components in food production, agriculture, medicine, and manufacturing of fibers and plastics. The Federal Government seeks to reduce its dependency on oil and gas from other nations by continuing to locate and develop its own reserves.

The current Forest Plan does not adequately address the availability of lands on the Forest for oil and gas leasing. As a result, leasing on the Forest has been suspended pending the decisions made as a result of this document. The Record of Decision (ROD) to this document will discuss what lands will be available and authorized for oil and gas leasing and with what constraints (stipulations).

This chapter discusses why we have prepared this Final Environmental Impact Statement. This chapter describes Forest Service policy relating to minerals management on National Forest System lands; the current leasing situation in the Rocky Mountain Region of the Forest Service; the decisions to be made in the Record of Decision (ROD) for this document; the lands involved in the decisions; the need for the decisions; implementation of the decisions; the oil and gas leasing process; and the issues that surfaced during public involvement and scoping.

This FEIS is tiered (40 CFR Parts 1502.20 and 1508.28) to the Forest Plan FEIS. Copies of the Forest Plan FEIS are available from the Supervisor's Office and at all Ranger District Offices on the Forest; in the Regional Forester's Office; in the Supervisor's Office of all National Forests contiguous to this Forest and in most public libraries in or near this Forest.

The Bureau of Land Management (BLM) is a cooperating agency in the preparation of this document. BLM personnel have participated in scoping, interdisciplinary (ID) team meetings and have prepared specialist reports in the areas of groundwater, geology, and the Reasonably Foreseeable Development (RFD) scenario.

Changes Made Between Draft and Final

Numerous changes have been made to the Draft Oil and Gas Leasing EIS to reflect the comments we received from the public and other agencies, to supplement the information disclosed in the Draft, to update information that has changed in the past months, and to correct typographical and

grammatical errors. The discussion below highlights the major changes to the document. Other changes are pointed out, as necessary, in the Response to Comments in Chapter VI.

In Chapter I, information on the current situation has been updated, a discussion of a most development scenario was added to the section on the Reasonably Foreseeable Development (RFD) scenario, and clarification of discussions were added based on public comment. It should also be noted that all leases now have a ten year term as a result of language included in the Energy Policy Act of 1992.

In Chapter II, Alternative 2 - Preferred was revised. The Whetstone Mountain, Flat Top Mountain and portions of the Priest Mountain Roadless Areas, and the Kebler Pass corridor (which includes portions of the West Elk and Raggeds Roadless Areas) have been added to the list of areas not available for oil and gas leasing. A discussion of recreation use and opportunities was added to the Alpine/Tundra environmental consequence table and Figures II-1 through II-5 were clarified by displaying Standard Lease Terms in yellow.

In Chapter III, the air quality discussion was revised and several maps were updated, revised, and added as needed.

In Chapter IV, the air quality environmental consequences section was revised; sections on the impacts to State Highways and to recreation use and opportunities in Alpine/Tundra were added; Table IV-4 which displays the lease options by Roadless Areas was added; and further discussions of coal bed methane and the potential for timber harvest and cumulative effects are included in this FEIS.

In Chapter VI, Response to Comments were added.

A stipulation for Major Trails was added to Appendix C; the stipulation displayed in Appendix D is new; information was added to the RFD in Appendix E; and Appendices K through O were added to the document.

Appendix K is a Table of Required Permits (before drilling).

Appendix L lists existing oil and gas leases as of 2/11/93.

Appendix M is the Forest's Oil and Hazardous Spill Contingency Plan.

Appendix N is the Biological Assessment (Threatened, Endangered, and Proposed species).

Appendix O is the Biological Evaluation (sensitive species and species of concern).

Forest Service Minerals Management Policy

The availability of mineral and energy resources within the National Forests and Grasslands significantly affects the development, economic growth, and defense of the Nation . The mission of the Forest Service in relation to minerals management is to encourage, facilitate, and administer the orderly exploration, development, and production of mineral and energy resources on National Forest System (NFS) lands to help meet the present and future needs of the Nation (Forest Service Manual 2800 Zero Code - WO Amendment 2800-91-1 page 3).

Most of the statutes that govern the management of NFS lands suggest that all uses of NFS lands are to be considered on their merits and decisions should be made as to which mix of land uses would best meet the needs of the public. The Federal Land Policy and Management Act of 1976 (FLPMA)

specifies that public lands are to be managed in a manner that recognizes the need for a domestic source of minerals. The Multiple-use Sustained Yield Act declared that the NFS lands are to be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes, but also expressly provides that the Act shall not be construed to affect the use or administration of mineral resources on these lands. The Department of Agriculture believes that mineral development is an important and beneficial use of NFS lands, and that the effect of the relevant statutes is to require that such use be considered in concert with other resources and values. Experience has shown that, in most cases, land uses, including oil and gas exploration and development can be compatible, or that conflicts with other resources can be adequately managed to allow oil and gas operations. When this is not possible, decisions must be made as to which set of resource values and land uses would provide the public the greatest benefit.

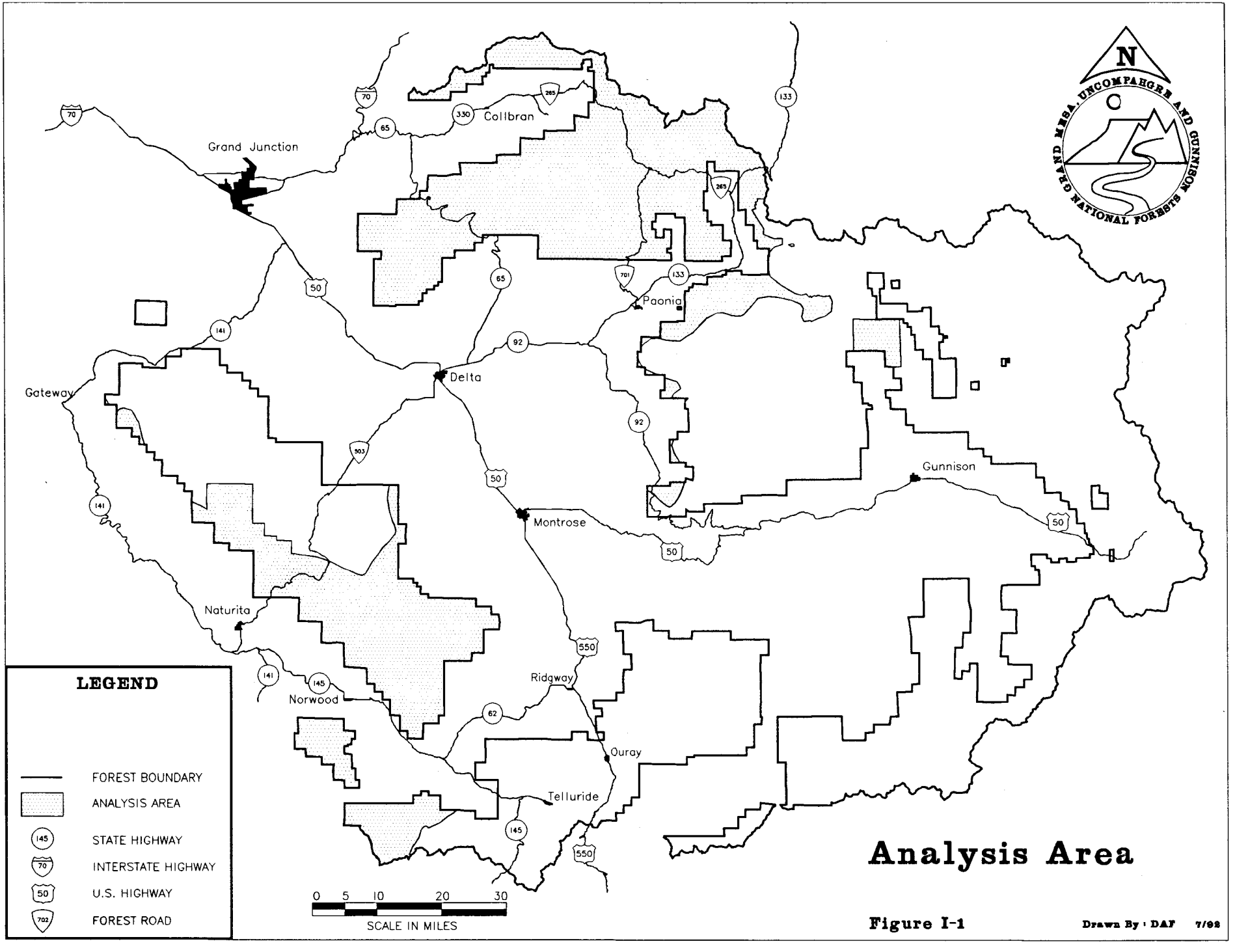
The Federal Onshore Oil and Gas Leasing Reform Act (FOOGLRA or the Leasing Reform Act) of 1987 authorized the Secretary of Agriculture to develop procedures and regulations governing leasing for oil and gas resources, including bonding and reclamation requirements, within the National Forest System. This authority was formerly exercised by the United States Department of Interior (USDI) Bureau of Land Management (BLM). Regulations governing the role of the Forest Service in oil and gas leasing operations on NFS lands were issued March 20, 1990 (36 CFR 228 Subpart E). These regulations promote cooperation between the Forest Service, BLM, industry, and the public.

In announcing the regulations, Forest Service Chief F. Dale Robertson said, "*We recognize that a component of the Nation 's energy supplies must derive from the public resources on National Forests and rangeland, and also recognize the mandate to conserve the environmental quality of these regions. The regulations were created to assure that oil and gas production on NFS lands continues, but only in an environmentally sound manner.*"

The Chief's thoughts are reflected in the Forest Service Manual (FSM) which states that the Forest Service administers its mineral program to (from FSM 2802):

> "*1. Encourage and facilitate the orderly exploration, development, and production of mineral and energy resources within the National Forest System in order to maintain a viable, healthy minerals industry and to promote self-sufficiency in those mineral and energy resources necessary for economic growth and the national defense.*
>
> *2. Ensure that exploration, development, and production of mineral and energy resources are conducted in an environmentally sound manner and that these activities are considered fully in the planning and management of other National Forest resources.*
>
> *3. Ensure that lands disturbed by mineral and energy activities are reclaimed for other productive uses.*"

> Similarly, from FSM 2822.03: "*The Forest Service considers mineral exploration and development to be important parts of its management program. It cooperates with the Department of Interior (USDI) in administering lawful exploration and development of leasable minerals. While the Forest Service is mainly involved with surface resource management and protection, it recognizes that mineral exploration and development are ordinarily in the public interest and can be compatible in the long term, if not immediately, with the purposes for which the National Forest System lands are managed.*"


N
GRAND MESA, UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS
Grand Junction
Collbran
Paonia
Delta
Gateway
Montrose
Gunnison
Naturita
Norwood
Ridgway
Ouray
Telluride
LEGEND
FOREST BOUNDARY
ANALYSIS AREA
STATE HIGHWAY
INTERSTATE HIGHWAY
U.S. HIGHWAY
FOREST ROAD
0 5 10 20 30
SCALE IN MILES
Analysis Area
Figure I-1
Drawn By : DAF 7/92

Current Situation

On October 26, 1988, oil and gas leasing was suspended on five National Forests in R2, including the Grand Mesa, Uncompahgre and Gunnison. A review of the Forest's Land and Resource Management Plan (Forest Plan) and associated environmental documents indicated that additional documentation was needed to fully support Forest Service leasing consent decisions in accordance with the Leasing Reform Act. The Forest Plan predates the Leasing Reform Act and contains only general management direction for oil and gas exploration and development.

Oil and gas activities may still occur on leases issued prior to the suspension of oil and gas leasing. In 1990, R2 had over four million acres under lease for oil and gas. An estimated $36 million was collected on National Forest System lands in 1990; from rentals, bonuses, and royalties from mineral activities (including coal). Program administration costs were $2.2 million.

This Forest has existing oil and gas leases that cover approximately 185,000 acres, with the majority of the leases concentrated on the north end. The existing leases and their administration will not be affected by this analysis. In fiscal year 1992 (FY 92), the Forest had seven wells actively producing natural gas, located on both the Paonia and Collbran Ranger Districts. The seven wells produced a total of 400,000 thousand cubic feet (MCF) of natural gas and 1132 barrels of oil in FY 92.

Lands Involved

The lands involved in the *Leasing Analysis* are located in west-central Colorado and comprise the Grand Mesa, Uncompahgre and Gunnison National Forests (see map Fig. I-1). The Grand Mesa and Uncompahgre National Forests were administratively combined in 1954 and the Gunnison was added in 1973 for a total 2,953,186 acres of National Forest System land. The Forest includes portions of Delta, Garfield, Gunnison, Hinsdale, Mesa, Montrose, Ouray, Saguache, San Juan, and San Miguel Counties.

The Forest is characterized by a large amount of intermingled ownership. Within the Forest boundary, there are 210,217 acres in private, State, or other Federal agency ownership.

Direction for *Leasing Analyses* issued by the Chief's office (Interim Directive 2820-91-1; January 2, 1992, Appendix A), states that Forest's should give priority to areas of the Forest in which there is interest in leasing (Interim Directive 2820-91-1; 2822.94a). The direction defines interest in leasing as:

1. *An interest in leasing has been expressed by the oil and gas industry;*
2. *There has been oil and gas production nearby;*
3. *The geologic environment is favorable for oil and gas to have accumulated;*
4. *There are State, private, or Federal leases in the vicinity;*
5. *Geophysical exploration has been done recently; or*
6. *The BLM indicates that lands have been nominated for lease.*

Based on this direction, the analysis area covered in this FEIS includes those areas of high and moderate potential for oil and gas resources and those areas of low and no known potential for oil and gas resources that are currently leased. The areas with low and no known potential for oil and gas resources do not meet the criteria for interest, listed above. Note also, that in those areas of low and no known potential for oil and gas resources only 8200 acres of the roughly 1.5 million acres legally available are currently leased. This is an indication of the lack of interest in leasing of those lands.

The resulting analysis area is displayed on Figure I-1. The analysis area contains approximately 951,450 acres. No NFS lands have been formally withdrawn from mineral leasing. (Wilderness, Wilderness Study Areas and further planning areas are legally unavailable for leasing [36 CFR 228.102(b)(3)], however, there are none within the analysis area.) An amendment to the regulations removed the exclusion of some Roadless Areas from oil and gas *Leasing Analysis* (published in the Federal Register 11/1/91). The intended effect is to enable the Forest Service to include Roadless Areas in oil and gas *Leasing Analyses.*

Within the analysis area there are a number of land categories, each of which suggests a different management strategy, or decision, in terms of oil and gas leasing. Based on public comments and/or Interdisciplinary Team concerns, the following *Affected Environments* were identified, mapped and digitized for the purpose of this analysis, and are described in Chapter III - Affected Environment. Site specificity in this document is represented by the discussions of each of the *Affected Environments.*

TABLE I-1. AFFECTED ENVIRONMENTS WITHIN ANALYSIS AREA

Affected Environment	Acres*
General Forest (Analysis Area)	951,450
Floodplains	10,200
Aquatic/Riparian/Wetland Habitats	27,600
Alpine/Tundra Areas	2,100
High Geologic Hazard Areas	52,000
Moderate Geologic Hazard Areas	629,000
Roadless Areas	345,030
Research Natural Areas	655
Sensitive Areas	29,000
Retention VQO	7,800
Retention VQO and Low VAC	7,210
Scenic Byway Corridors	18,140
Semi-primitive Non-motorized (3A Management Areas)	13,700
Administrative Sites	35
Recreation Complexes (Developed, Dispersed, Trails)	62,975
Watersheds of Special Interest to Municipalities	117,000

TABLE I-1. AFFECTED ENVIRONMENTS WITHIN ANALYSIS AREA	
Affected Environment	**Acres***
Slopes 40-60%	33,530
Slopes > 60%	3,415
Big Game Winter Range	207,450
Elk Calving Areas	45,230
Big Game Migration Routes and Staging Areas	-- **
Bighorn Sheep Lambing and Breeding Areas	9335
Big Game Summer Range (Concentrated Use)	81,440
Sage Grouse Leks	160
Utility Corridors/Electronic Sites	4535
Primary Rangeland (6B Management Areas)	395,000
Lands Suited for Timber Harvest	287,000

* Note: Many of these environments overlap. Acreages do NOT add up to the analysis area total.
** See discussion page III-99.

Decisions to be Made

Three decisions will be made.

1. Identify which lands, if any, will be administratively available for leasing to private individuals or firms and the stipulations that must be applied to their respective leases.

2. Identify which of the lands that are administratively available, if any, the BLM will be authorized to lease - subject to later review of the identified lease parcel and consent by the Forest Service.

3. Amend the Forest Plan to reflect the leasing decisions that have been made.

Regulations prescribe Forest Service responsibilities in the issuance of Federal oil and gas leases and the management of subsequent oil and gas operations on NFS lands (36 CFR 228.100(a)). These regulations (36 CFR 228.102(c)) require the authorized Forest officer (in this case, the Forest Supervisor) to conduct a *Leasing Analysis* that:

(1) Identifies on maps those areas that will be: (emphasis added)

i. Open to development subject to the terms and conditions of the standard oil and gas lease form (including an explanation of the typical standards and objectives to be enforced under the standard lease terms);

ii. Open to development but subject to constraints that will require the use of lease stipulations such as those prohibiting surface use on areas larger than 40 acres or such other standards as may be developed in the plan for stipulation use (with discussion as to why the constraints are necessary and justifiable); and

iii. Closed to leasing, distinguishing between those areas that are being closed through exercise of management direction, and those closed by law, regulation, etc.

(2) Identifies alternatives to the areas listed above, including that of not allowing leasing.

(3) Projects the type/amount of post-leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program consistent with that described in the proposal and for each alternative.

(4) Analyzes the reasonable foreseeable impacts of projected post-leasing activity.

This FEIS documents the *Leasing Analysis* for the Grand Mesa, Uncompahgre and Gunnison National Forests. The regulations require *Leasing Analyses* to comply with the National Environmental Policy Act (NEPA) of 1969, implementing regulations at 43 CFR 1500-1508 and Forest Service implementing policies and procedures set forth in Forest Service Manual 1950 and Forest Service Handbook 1909.15 (36 CFR 228.102(a)).

The *Leasing Analysis* will result in a decision as to which lands, if any, will be administratively available for leasing and what terms and stipulations would be attached to the lease (36 CFR 228.102 (d)).

The *Leasing Analysis* will also identify which of the lands that are administratively available, the BLM will be authorized to lease, subject to (36 CFR 228.102(e)):

(1) Verifying that oil and gas leasing of the specific lands has been adequately addressed in a NEPA document, and is consistent with the Forest land and resource management plan.

(2) Ensuring that conditions of surface occupancy identified in 36 CFR 228.102 (c)(1) are properly included as stipulations in resulting leases.

(3) Determining that operations and development could be allowed somewhere on each proposed lease, except where stipulations will prohibit surface occupancy.

In much simpler terms, the decision to be made is which of the following five lease options would apply for each of the *Affected Environments* to be analyzed for oil and gas leasing:

- No Lease (NL)
- Lease with No Surface Occupancy (NSO)
- Lease with Controlled Surface Use (CSU)
- Lease with Timing Limitations (TL)
- Lease with Standard Lease Terms (SLT)

For every *Affected Environment* within the analysis area, we are deciding whether that *Affected Environment* is available (the "d" decision) **and authorized** (the "e" decision) **for oil and gas leasing**. The "d" and "e" decisions refer to decisions specifically required in 36 CFR 228.102 (d) and (e). We are making decisions to a map resolution of approximately 40 acres.

This is distinct from a Forest-wide program decision regarding the level of or emphasis on oil and gas leasing. That decision has essentially already been made and is well articulated in the minerals program objectives (FSM 2802) presented on page I-2. The "discretion" of the Forest Service in regulating surface use is to ensure that oil and gas activities on National Forest System lands are conducted in a manner that is environmentally sound and consistent with other surface resource values. This includes not allowing leasing or surface occupancy where surface resource values need to be protected .

The level of oil and gas leasing on a given Forest with existing oil and gas resources is determined largely by the market for these resources and industry's perceptions about the profitability of exploration and development. One factor influencing this judgement is the nature of the stipulations and restrictions imposed by the Forest Service as the surface management agency. The Forest Service has the authority to impose reasonable restrictions on oil and gas leasing activities only after "less restrictive stipulations were considered and determined to be insufficient" (Uniform Format for Oil and Gas Lease Stipulations, as adopted by Chief's 2820 letter dated 5/31/1989). Sufficiency in this case refers back to the minerals program objectives items 2 and 3 (see page I-3). We are required to discuss "*why the constraints* (stipulations) *are necessary and justifiable*" (36 CFR 228.102(c)(1)(ii)).

The decisions to be made in this analysis do not determine the emphasis for oil and gas leasing and development on the Forest; but rather, **determine whether each *Affected Environment* analyzed will be available and authorized for leasing and what stipulations are necessary to sufficiently protect resource values to an acceptable standard, within the existing minerals program emphasis .**

However, once the management strategy for the specific *Affected Environments* is decided (a lease option has been chosen for each *Affected Environment*), the additive consequence of these decisions represent a Forest-wide program. The consequences of this "program" also need to be considered in making a final decision. One requirement of 36 CFR 228.102(c)(3) is to "*project the type/amount of post leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program consistent with that described in the proposal and for each alternative*" (emphasis added). We are obligated to compare this overall program (i.e., the preferred alternative (Alt. 2)) with at least 3 other alternatives: 1) the No Action alternative (Alt. 1), interpreted as continuation of current leasing policies reflected in the Forest Plan, 2) a No leasing alternative (no new leases) Forest-wide (Alt. 3), and 3) leasing all available areas with Standard Lease Terms (Alt. 4). One additional alternative has been developed in response to the significant issue of roadless and undeveloped areas (Alt. 5).

This dual "*Affected Environments*" plus "Forest-wide program" effects analysis suggests a two-tiered analysis process.

We must first consider the effects of the five lease options on each *Affected Environment*. Then we must examine (and disclose) the consequences of the resultant Forest-wide program and compare them with the consequences of the other "Alternatives".

The real DECISIONS TO BE MADE are which of the five lease options (including no lease) do we choose for each of these *Affected Environments*, considering both the onsite effects and the overall effect on the Forest program.

No Surface Occupancy, *Controlled Surface Use*, *Timing Limitations* and *Standard Lease Terms* make *Affected Environments* available, but with differing surface use requirements. *No Lease* applied to a given *Affected Environment* means it is not available for oil and gas leasing.

Our direction for making these decisions is the encouragement of oil and gas resource exploration, development and production, while imposing those restrictions necessary to ensure that the activities are environmentally sound and consistent with Forest Plan multiple use objectives.

Upon completion of the *Leasing Analysis*, the Forest Service shall promptly notify the BLM that Forest-wide leasing decisions have been made. These decisions will be displayed in the Record of Decision (ROD) that will accompany the FEIS. The BLM, responsible for the management of all Federally-owned leasable minerals, may offer and lease NFS lands authorized for leasing in the ROD.

The Forest Supervisor will make the decisions only after studying the comments received from the public on the Draft EIS. This FEIS responds to those comments. The ROD, which will accompany the FEIS, will describe all decisions. The decisions will be represented on a series of quadrangle scale (1:24000) maps that will be used in implementation. Information disclosed on the maps will include what stipulations are required and a discussion of why stipulations are necessary and justifiable (36 CFR 228.102 (c)(ii)). Because of the number of maps involved and the costs to reproduce them, they will not be distributed with the FEIS. However, they will be made available for review upon request at several locations, including the Regional Office in Denver, the Supervisor's Office in Delta and at Ranger District Offices.

The ROD will not authorize any ground-disturbing activities. Site-specific ground disturbing activities are identified at the time an Application for Permit to Drill (APD) and Surface Use Plan of Operations (SUPO) has been provided to the Forest Service for approval. (See the discussion on implementation, pages I-17 to I-19.) At that time, the Forest Service will analyze the proposal (in an Environmental Assessment [EA] or EIS) and issue a decision document (Finding of No Significant Impact [FONSI] or ROD).

The Forest Supervisor will determine whether the proposed changes are significant or non-significant (36 CFR 219.10 (f)). If the Forest Supervisor decides that the leasing availability decision is a non-significant change to the Forest Plan the reasoning will be explained in the decision document. If the Supervisor feels the decision results in a substantial change to the Forest Plan the Regional Forester must decide how the plan will be amended. The Regional Forester will prepare a decision document based on environmental analysis and public disclosure.

This document will disclose the information needed for the Forest Supervisor to determine if a Forest Plan Amendment will be required, and whether or not that amendment is significant. The Supervisor may refine the availability determinations made in the Forest Plan, identify specific mitigation requirements to be applied at the time of leasing and allow more specific mitigation to be identified at the time a Surface Use Plan of Operations (SUPO) is being analyzed.

This EIS

The Two-Tiered Analysis Process

From our discussion above it is apparent that there are two points in the decision-making process for this FEIS (making the "d" and "e" decisions) which need to be supported by environmental analysis. The first point decides which of the five lease options should be imposed. The second point considers the overall effects of the entire program compared with other possible programs (alternatives) within the discretionary choice of the agency. The sequence of the analysis documented in this FEIS and which supports the decision ultimately documented in the Record of Decision, follows this approach.

The First Level of Analysis

Typical oil and gas exploration and development activities are described in Appendix G. A discussion of the restrictions associated with each of the five lease options and how they effect oil and gas activities is found on pages I-15 to I-16. In Chapter III, each of the *Affected Environments* is described. In Chapter IV, the environmental consequences of leasing under each of the five lease options is described for each *Affected Environment*.

Using this information, the Forest Supervisor, through a facilitated interdisciplinary review and decision meeting held on April 16, 1992, identified his choices for which lease option would be applied to each of the *Affected Environments*. This resulted in a tentatively *Preferred Alternative* or proposed action, in NEPA terms (Alternative 2). The other Forest program alternatives which deserve consideration were identified at the same time (Alternatives 1, 3, 4, 5).

The Second Level of Analysis

Table II-5 (pages II-9 through II-10), describes the Forest-wide program alternatives that are carried all the way through the analysis; including the No Action Alternative (Alt. 1), the complete No Lease Alternative (Alt. 3), and the alternative of making everything "*open to development subject to the terms and conditions of the standard oil and gas lease form*" (36 CFR 228.102(c)(1)(i)) (Alt. 4). The Reasonably Foreseeable Development Scenario (RFD), in Appendix E, describes the anticipated oil and gas activity within the analysis area. How this RFD fits into the overall analysis is discussed in the section below. The environmental consequences of the five Forest-wide program alternatives are described in Chapter IV (pages IV-39 - IV-86).

In a second review and decision meeting held on May 12, 1992 the Forest Supervisor used this information to finalize the *Preferred Alternative* (Alternative 2) for the purpose of the draft. After reviewing public comment on the DEIS, the *Preferred Alternative* was modified at a November 20, 1992 meeting, and is presented in this FEIS.

Land Availability (36 CFR 228.102(d))

To comply with the procedural requirements of the leasing regulations (which require compliance with NEPA), a set of maps displaying alternative patterns of lands available for leasing on the Forest have been prepared. The maps include the stipulations that will apply to all available land areas and the resource values driving the need for the stipulations. A generalized stipulation map is included in this document. Maps at a 1:24000 scale are available for review at the Regional Office in Denver, the Supervisors Office in Delta, at each Ranger District on the Forest (maps of that District only), and the BLM office in Denver.

Each alternative map shows the areas "*open to development subject to the terms and conditions of the standard oil and gas lease form, open to development but subject to constraints that will require the*

use of lease stipulations " and areas "*closed to leasing.*" Notations will be made on the maps to indicate "*those areas that are being closed through exercise of management direction, and those closed by law, regulation, etc.*" (36 CFR 228.102(c)).

The array of alternatives is designed to meet the requirements of both the oil and gas regulations and NEPA. The range of alternatives includes:

- Make all lands not available for leasing (Alternative 3);
- Make all lands **available with standard stipulations** (Alternative 4);
- Make some lands available with **mixtures of standard and supplemental stipulations** (Alternatives 1, 2 and 5).

Leasing Specific Lands (36 CFR 228.102(e); ID 2822.9)

Having selected the lands that are "administratively available for leasing", the Forest Supervisor will proceed to the second decision, which is to determine which of those available lands to specifically authorize for leasing. The specific lands decision will be made on the basis of knowledge of the possible environmental effects (summarized in Chapter II and in Chapter IV) gathered from the availability analysis and the ability of the Forest Supervisor to "*verify that oil and gas leasing on the specific lands has been adequately addressed according to the requirements of the National Environmental Policy Act, that conditions of surface occupancy are properly included as stipulations in the leases,*" and that "*operations and development could be allowed somewhere on each proposed lease, except where stipulations will prohibit all surface occupancy.*"

The Need for Decisions

There are legal and practical needs for these decisions. The legal needs for these decisions have been described above (see Decisions to be Made, page I-7). The Forest Supervisor also has several other reasons to make these decisions, at this time:

1. Since the suspension of leasing on the Forest there have been numerous requests for leases;

2. Additional lease requests are anticipated and;

3. The Forest Plan does not adequately address oil and gas leasing in respect to the Leasing Reform Act.

During the period between suspension of leasing activity following passage of the Leasing Reform Act and the present, firms applied to the BLM for leases on portions of the Grand Mesa, Uncompahgre, and Gunnison National Forests. The BLM and the Forest Service could not properly act upon lease requests prior to completion of a *Leasing Analysis*. The Forest currently has ten lease requests needing action. As a result of this *Leasing Analysis*, the Forest Supervisor needs to determine which lands are available for leasing, and which of the ten outstanding lease requests should be authorized. (Lease requests over two years old are deleted from the database.)

The Forest currently has 124 existing leases (as of 1/27/93). (See Appendix L.) About fifty percent (50%) of these leases are expected to expire within ten years. The others are not expected to expire because they have wells currently producing or have wells capable of producing oil or gas and have been extended. The lands currently leased will be analyzed, so that, if they do expire, the decision will have

been made whether to offer them for resale and what stipulations would be attached to the lease if they were to be leased again. It is possible that currently leased lands would not be available for lease or would be available with stipulations that are not in the current lease.

Prior to this analysis, the Forest reacted to lease requests, individually. This involved the preparation of individual environmental analyses. When lease requests are studied on an individual basis, it is difficult to determine the cumulative environmental effects of the operations. This FEIS is an opportunity to plan for the orderly management of the Forest, resolve potential conflicts in land or resource use, and study the aggregate and cumulative effects of oil and gas leasing from a Forest-wide perspective.

Each administrative unit of the NFS is governed by a Forest Plan. Forest Plans provide broad, programmatic direction for the management of a National Forest. This direction is in the form of goals, objectives, land use determinations, management prescriptions, and standards and guidelines to be applied to individual projects. The existing Forest Plan includes general management direction to make lands administratively available for oil and gas leasing, but does not include decisions for leasing specific lands. Forest Plans normally do not document site-specific decisions; that is the role of project-level environmental analysis.

The Leasing Process

In many places in the United States, NFS lands are underlain by geological formations which do, or may, contain valuable quantities of oil or natural gas. Private firms purchase "leases" on many of these lands to search for oil or gas, to drill exploratory wells, and to extract any oil or gas located below them.

A Lease

The government conveys limited rights to the purchaser of a lease (see BLM form 3100-11, Appendix B). The lessee has the exclusive right to: (1) drill for, mine, extract, remove and dispose of all the oil and gas (except helium) in the leasehold, and (2) build and maintain necessary supporting facilities for the term of the lease. The oil and gas lease does not convey the right to build housing, cultivate the land, or remove any minerals other than oil and gas. Lease rights provide that drilling and development take precedence over rights the government may subsequently grant other users of the area, such as ranchers or recreationists. If the government has previously granted privileges by permit to others such as ranchers, those granted by the earlier permit will take precedence over the lease rights. A lease is normally issued for a period of five or ten years and is extended if it is producing oil or gas in "paying" quantities or has produced or is capable of producing in paying quantities (43 CFR 3107).

Individuals, associations of citizens, and corporations organized under the laws of the United States or any State, are entitled to lease Federal lands for these purposes under authority of the Mineral Leasing Act of 1920 as amended, and the Mineral Leasing Act for Acquired Lands of 1947 unless the lands have been specifically withdrawn by the responsible Federal agency. Leases also may be issued to a legal guardian or trustee on behalf of a minor. Aliens, whose country of origin does not deny similar privileges to U.S. citizens may hold interest in leases, but only through stock ownership of United States corporations that hold leases. Aliens may not hold interest in Federal oil and gas leases through units in publicly-traded limited partnerships.

Competitive and **noncompetitive** leases may be obtained for oil and gas exploration and development on lands owned or controlled by the Federal Government. The Leasing Reform Act requires all public lands available for oil and gas leasing to be offered first by competitive leasing at an oral action.

Noncompetitive leases may be issued only if the competitive process results in no bids. Both competitive and noncompetitive leases are issued for a ten-year period. Both are extended for the duration that they are producing oil and gas in paying quantities. The maximum competitive lease size is 2,560 acres (four sections) in the lower 48 states and 5,760 acres in Alaska. The maximum noncompetitive lease size is 10,240 acres in all states.

Competitive Leases

The BLM conducts oral auctions for oil and gas leases on at least a quarterly basis, when there are available parcels of land. A Notice of Competitive Lease Sale lists lease parcels to be offered at auction. The Sale Notice is published at least 45 days before the date of the auction and identifies any lease stipulations to uses or restrictions on surface occupancy. There are three sources for Federal lands available for lease:

1. Existing leases which have expired, and leases which have been terminated, canceled, or relinquished.

2. Parcels identified by informal expressions of interest from either the public or BLM for management reasons.

3. Lands included in offers filed for noncompetitive leases (effective January 3, 1989).

On the day of the auction, successful bidders must submit a properly executed lease bid form and make a payment consisting of a share of the sale costs ($75 per lease), one year advance rental ($1.50 per acre), and not less than the $2.00 per acre minimum bonus. The balance of the bonus bid must be received within 10 working days of the auction.

The bid form (Appendix B) constitutes the legally binding lease offer.

Noncompetitive Leases

Noncompetitive leases may be issued only for parcels which have been offered competitively and failed to receive a bid. Lands in expired, terminated, canceled or relinquished leases are not available for noncompetitive leasing until they have been offered competitively. After an auction, all lands that were offered competitively without receiving a bid are available for issuance of noncompetitive leases for a period of two years.

Noncompetitive offers must be submitted on BLM Form 3100-11 (June 1988), Offer to Lease and Lease for Oil and Gas (Appendix B), and they must include a $75 filing fee, and one year advance rental ($1.50 per acre).

Noncompetitive lease offers filed on the first business day following the auction are considered as having been filed simultaneously. The priority among multiple offers received on the first business day for the same parcel are determined by drawings open to the public.

Royalties

The United States receives a royalty of 12 1/2% based on the value of production removed or sold. It is paid either in value (dollars) or in kind (oil or gas).

Bonding

Prior to starting drilling operations, the lessee must submit a surety or personal bond as described in the BLM regulations (43 CFR 3104). The bond for an individual lease is $10,000. Lessees may furnish

a State-wide bond of $25,000 or a nation-wide bond of $150,000. If their bonds are not adequate to ensure complete and timely reclamation, the Forest Service will require a bond based on the estimated reclamation costs. This can be an increase in the instrument held by the BLM or a separate instrument held by the Forest Service. The Forest Service, at any time, may review the bond and require additional bonding. Usually increased bond amounts are determined as part of the APD appraisal process. The Forest Service may also, at the operators request, reduce or release liability to the extent that reclamation has been completed.

Stipulations

The *Standard Lease Terms*, contained on BLM Form 3100-11 (June 1988), Offer to Lease and Lease for Oil and Gas (See Appendix B), provide the lessee the right to use the leased land as needed to explore for, drill for, extract, remove and dispose of oil and gas deposits located under the leased lands. The lessee must conduct operations in a manner that minimizes adverse impacts to the land, air, water, cultural, biological, visual, and other resources, as well as other land uses or users. Federal environmental protection laws such as the Clean Water Act, Endangered Species Act, and Historic Preservation Act, will be applied to all lands and are included in the standard lease stipulations. The *Standard Lease Terms* require that if threatened or endangered species, objects of historic, cultural or scientific value, or substantial unanticipated environmental effects are encountered during operations, all work affecting the resource will stop and the land management agency will be contacted. Operations which would destroy or harm these species or objects are prohibited.

Standard Lease Terms provide for reasonable measures to minimize adverse impacts to surface resources. *Standard Lease Terms* include, but are not limited to, modifications to the siting or design of facilities, timing of operations, and specifications of interim and final reclamation measures.

A lease does not convey an unlimited right to explore or an unlimited right to develop any oil or gas resources found under the land. Leases are subject to terms and conditions. These are restrictions derived from legal statutes and measures to minimize adverse impacts to other resources and are generally characterized in a lease as ***stipulations***. Stipulations modify the rights the government grants to a lessee. The stipulations are known by potential lessees prior to any lease sale, and must be applied at the time of APD. *Standard Lease Terms* can be modified by special or supplemental stipulations, which may be attached to the lease. Additional special stipulations can be developed specifically to meet resource concerns that cannot be mitigated by existing stipulations. All stipulations which may be applied when implementing the Forest Supervisor's decisions are detailed in Appendix C.

The Rocky Mountain Regional Coordinating Committee published "Uniform Format for Oil and Gas Stipulations" in March 1989. A uniform format for stipulations was developed for the categories of: (1) no surface occupancy, (2) timing or seasonal restriction, and (3) controlled surface use. This guidance includes the use of lease notices. There is also provision for special administration or unique stipulations, such as those required by prior agreements between agencies or other instances when standardized forms are not appropriate. These formats have been adopted for nationwide use by the Chief (2820 letter; 5/31/89).

The *No Surface Occupancy (NSO)* stipulation is intended for use only when other stipulations are determined insufficient to adequately protect the public interest. *No Surface Occupancy* means just that. No roads, buildings, well pads, and pipelines would be allowed. No disturbance or use of the surface would be allowed in those *Affected Environments* where the *No Surface Occupancy* stipulation is selected, except if waived, excepted or modified. (See Waivers, Exceptions and Modifications, below.)

The *Timing Limitation* stipulation prohibits oil and gas mineral exploration and development activities for time periods less than yearlong. This stipulation does not apply to the operation and

maintenance of production facilities unless the analysis findings demonstrate the continued need for such mitigation and that less stringent, project-specific mitigation measures would be insufficient, i.e., this stipulation may be applied to operation and maintenance of production facilities if the need is identified in the APD and subsequent NEPA documents.

For example, a *Timing Limitation* might be used to protect an elk calving area during the elk calving period, or to prevent excessive soil erosion and stream sedimentation resulting from construction activities during periods when soils are saturated. The *Timing Limitation* would not allow surface use during a prescribed period of time on all or a portion of the lease. The *Timing Limitation* may also specify that the restrictions apply when certain surface conditions exist, such as water saturated soils or during spring thaws when road beds are too soft to allow traffic without unacceptable damage to the road.

The *Controlled Surface Use (CSU)* stipulation is intended for use when oil and gas development is generally allowed on all or portions of the lease area year-round, but because of special values, or resource concerns, lease activities must be strictly controlled. The *CSU* stipulation is used to identify constraints on surface use or operations which may otherwise exceed the mitigation provided by section 6 of the *Standard Lease Terms* (see BLM form 3100-11 [June 1988], in Appendix B), existing regulations and Onshore Oil and Gas Orders.

The use of *CSU* stipulations should be limited to areas where restrictions and controls are necessary for specific types of activities within the specific *Affected Environments*, rather than all activity on the lease. The stipulation should clearly describe the activity to be controlled or what operational constraints are required and must identify the applicable area and the reason for the requirement.

For example, a *CSU* stipulation might be used to protect the visual quality objectives of an area or to protect semi-primitive recreation values. To protect those resources, a *CSU* stipulation might be attached to the lease which specifies that access to the leasehold be restricted to the established road system. In this example, no new road construction would be allowed. The lessee would have to use the existing road system to conduct operations on his leasehold.

A *Lease Notice* is attached to leases to transmit information at the time of lease issuance to assist the lessee in submitting acceptable plans of operation, or to assist in administration of leases. *Lease Notices* do not involve new restrictions or requirements; they identify specific concern(s) that may impact lease operations on a given lease. Any requirements contained in a *Lease Notice* must be fully supported in either a law, regulation, *Standard Lease Terms*, or Onshore Oil and Gas Orders.

Special administration stipulations are used where the three uniform stipulation forms or *Lease Notices* do not adequately address the concern. They should be used only when special external conditions, such as pre-existing agreements with other agencies, require use of a one-of-a-kind stipulation that is not used in any other area or situation. The resource use or value, location, and specific restrictions must be clearly identified.

Waivers, Exceptions and Modifications

An operator submitting a SUPO may request the authorized Forest Officer to authorize the BLM to modify (permanently change), waive (permanently remove), or grant an exception (case-by-case exemption) to a stipulation included in a lease at the direction of the Forest Service. Compliance with NEPA is required. The authorized Forest Officer may authorize the BLM to modify, waive, or grant an exception to a stipulation provided:

1. The action would be consistent with applicable Federal laws;

2. The action would be consistent with the current Forest Plan;

3. The management objective which led the Forest Service to require the inclusion of the stipulation in the lease can be met without restricting operations in the manner provided for by the stipulation given a change in the present condition of the surface resources involved, or given the nature, location, timing, or design of the proposed operations;

4. The action is acceptable to the authorized Forest Officer based upon environmental review (36 CFR 228.104).

Decisions to modify, waive, or grant an exception to a lease stipulation shall be subject to administrative appeal only in conjunction with an appeal of a decision on a Surface Use Plan of Operations (36 CFR 228.104 (d)(2)). Waiver, modification, or exception to a restrictive stipulation may result in application of a less restrictive stipulation. For example an exception for NSO may result in a *Timing Limitation* to protect a resource or use that was previously covered by *NSO.*

The lease also requires that the lessee meet stipulation conditions or avoid activities within all, or an identified part, of the leasehold. All leases on NFS lands contain the "Stipulation for Lands of the National Forest System Under Jurisdiction of Department of Agriculture" (Appendix D) requiring the lessee to comply with the rules and regulations of the Department of Agriculture. All leases are subject to regulations and formal orders of the Secretaries of the Interior and Agriculture in effect at the time of issuance.

Implementation: The Staged Decision Process

Implementation is part of a four stage decision process. The U.S. Supreme Court in Robertson v. Methow Valley Citizens Council, 104 L.Ed.2d 351 (1989), upheld the use of more than one stage of NEPA compliance after a Forest Plan is issued. In the Methow Valley situation, there was a permit stage (which allowed no ground-disturbing activities) and a faster development plan stage which involved another NEPA process and decision by the Forest Service before ground-disturbing activities would be experienced. This is very similar to the situation that is involved here.

Forest Service policy is to generally support oil and gas activities, but proposed activities must not unduly harm the environment or disproportionately interfere with other uses of NFS lands. A regulatory framework has been created to meet industry's needs while protecting other resources. The regulations include staged permitting of oil and gas exploration and development. Those stages include public disclosure at the following decision points: (1) the determination of lands available for leasing, (2) the authorization to lease specific lands, (3) Application for Permit to Drill (APD) and (4) amendment of the permit to drill if field development occurs. Each decision is based on environmental analysis and disclosure of the probable effects is in accord with NEPA requirements and is appealable to the responsible Federal agency. Note that neither of the first two decisions authorizes ground-disturbing activities and that only decision points 1 and 2 are addressed in this document. Decisions regarding APD approval for individual wells or for wells drilled to develop a discovered field would be addressed in subsequent NEPA analyses.

Stage one identifies those lands available for leasing based on disclosure and analysis provided in a *Leasing Analysis*. The *Leasing Analysis* is a "programmatic" rather than a "site-specific" or "project" level activity. The *Leasing Analysis* is a plan level decision which will determine which, if any, lands will be identified as available for leasing and under what terms and stipulations. No rights are granted by the government to other parties when the *Leasing Analysis* is completed and the leasing availability decision described in the regulations (36 CFR 228.102(d)) is made. The BLM and Forest Service are cooperating agencies in the *Leasing Analysis.*

This decision enables the oil and gas industry to know which NFS lands may be available now or in the future for leasing, and with what stipulations. Forest Service publication of these decisions is

intended to enable the oil and gas industry to undertake long-range planning. However, at this point, the Forest Service makes no irreversible or irrevocable decisions to lease these lands.

Stage two makes leasing decisions for specific lands. As discussed above, the Leasing Reform Act also provides for authorization by the Forest Service to the BLM to offer and issue oil and gas leases for specific lands.

The Forest Supervisor may decide to authorize lease of all the lands described as "administratively available" in the *Leasing Analysis*, or to lease only a portion of the "available" lands. The actual authorization of BLM to advertise specific leases is considered to be an implementation step and will not be granted until the lease parcel has been identified.

The Forest has decided to administratively combine the leasing decision, with stage two, the leasing specific lands decision. Both of these decisions will be documented in the ROD. Once these decisions have been made and provided to the BLM they will work with industry to identify specific lease parcels to the Forest Service. At the time that the ROD is signed for the availability and specific lands decision, authority is not granted to the BLM to authorize a specific lease parcel. Authority to lease is granted only after a specific lease proposal has been received and reviewed by the Forest Service. The Forest Service may authorize or deny the lease parcel advertisement.

When the Forest Service receives a lease request and parcel identification from the BLM, the resource and stipulation maps, the *Leasing Analysis*, the availability determination , and authorization decisions will be reviewed. If the lands have been adequately addressed in a NEPA document with the proper stipulations attached and occupancy can be provided somewhere on the lease parcel, the Forest Service will notify the BLM and authorize the advertising of the parcel. If occupancy cannot be provided based on the review, the BLM will deny the request for leasing and work with the interested party and the Forest Service to determine if the parcel boundaries can be redefined to allow for occupancy or the parcel can be offered with a *No Surface Occupancy* stipulation. Even though the Forest Service consents to the offering of an oil and gas lease, the lease may ultimately not be issued by the BLM. At the time of offering no individual or firm may be interested in the parcel.

Stage three of the process is the Application for Permit to Drill (APD). Once the Forest Service authorizes the BLM to lease a specific parcel and the parcel has been sold, the rights to apply for permission to drill are granted to the lessee. However, prior to any ground disturbing activities the lessee must have an APD approved by the BLM. The APD includes a site-specific Surface Use Plan of Operations (SUPO). The BLM will then forward the application and the proposed SUPO to the Forest Service. The type, timing, size, and intensity of the proposed operations and the sensitivity of the surface resources that would be affected by the proposed operations determine the level of detail and the amount of information which the operator should include in the proposed SUPO. However, any SUPO submitted by an operator shall contain the information specified by Onshore Oil and Gas Orders in effect when the SUPO is submitted. An onsite review of the proposal is conducted prior to a final decision on the SUPO. Prior to approval, modification, or denial of the SUPO, the proposal will be analyzed by the Forest Service in a NEPA document (subject to appeal). If the proposal is denied, the lessee may make another proposal. It is only after the APD and SUPO are received, analyzed, and approved that the lessee receives the approval to begin ground disturbing activities. The SUPO review process is described in 36 CFR 228.107. The SUPO may be modified, approved, or even denied at this stage.

Appendix K is a table listing Federal, State and local permits necessary for oil and gas activities.

Lessees do not automatically or immediately drill exploratory wells on their leaseholds. Exploration for oil and gas resources is costly and speculative. Exploration firms consider what is known geologically about an area and available technology, capital, equipment, and market conditions in evaluating the risk of a drilling operation. Costly equipment, land rights, and expensive environmental protection measures may be required to carry out an oil and gas exploration program. As a result, oil

and gas leases are bought, relinquished, expire, and may be bought and sold again many times without ever being drilled upon.

If an APD is granted, the well or wells authorized may or may not be drilled. If the well is drilled, there is no guarantee that it will result in a discovery of oil or gas. Only about 15 percent of exploratory wells drilled in the United States result in a paying discovery of oil or gas. This is a major distinction between oil and gas leasing and other uses which are authorized by the Forest Service. Most other activities are reasonably certain to proceed to development after the permit or contract is issued.

Stage four. Submission of additional APD's is required for wells proposed to develop oil and gas resources found through exploratory activities. Operators may request approval of additional or supplemental SUPO's to allow development activities. At that time the Forest Service must analyze the effects of these proposals and issue a decision document stipulating conditions of use and development. In other words, after a discovery of oil or gas resources, an operator may request approval of additional APD's and SUPO's to develop the resources found. The analysis and decision made will be documented in a NEPA analysis.

Reasonably Foreseeable Development

In the assessment of environmental effects of an action, it is important to first clearly understand in detail what the action entails. The decision to grant lease rights on public lands conveys to the holder the right to explore for and to develop the oil and gas resources found there. In the most development possible scenario this could result in an intensely developed and roaded landscape, with all of the associated effects of this development. In such a case, the cumulative environmental effects discussed in Chapters II and IV of this EIS would be much greater.

However, the likelihood of such development levels is extremely remote. The factors of mountainous terrain, low producing gas reserves and low level of demand relative to other sources, combine to make the area covered in this EIS relatively unattractive for development. These and other factors affecting the levels of likely development are discussed in detail in Chapter II where the RFD is presented, and in Chapter VI where public comments are answered.

The regulations governing the preparation of this analysis repeatedly use the concept of what is "*reasonably foreseeable*". In addressing "incomplete and unavailable information", the 40 CFR 1500 regulations (at 1502.22) talk about "*evaluating reasonably foreseeable significant adverse effects*". In addressing cumulative impacts at 1508.7, the regulations refer to "*past, present, and reasonably foreseeable future actions...*". We believe that this NEPA language ties directly to the requirements of the 36 CFR 228 regulations also governing the preparation of this EIS.

The Forest Service is required by the regulations, at 36 CFR 228.102(c)(3 and 4), to "*Project the type/amount of post-leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program consistent with that described in the proposal and for each alternative and analyze the reasonable foreseeable impacts of post-leasing activity* " as a part of the analysis.

BLM staff specialists have projected the probable amount and pattern of future exploration and development. They have provided a "reasonably foreseeable development" (RFD) scenario to describe when and where oil and gas activities may take place. The RFD for this *Leasing Analysis* is in Appendix E.

The Reasonably Foreseeable Development Scenario (RFD) predicts the level of oil and gas exploration and development which will occur on the Forest in the next 15 years. This information is important in assessing the overall environmental, as well as social and economic impacts of such

development. Under the possible different programs represented by Alternatives 1 through 5, it is conceivable that more or less oil and gas activity would occur. Under the more restrictive Alternatives (3 & 5), the industry may choose to divert their activities elsewhere in the Forest, the State, or even the world. One of our regulatory obligations is to disclose the consequence of our decisions to the reasonably foreseeable amount of post-leasing activity (36 CFR 228.102(c)(3)). Assessing the impact of the 5 alternatives on the RFD allows us to do that.

The RFD does not suggest specific locations of potential wells beyond indicating a general area of anticipated occurrence (such as 5 wells in the area of moderate potential for oil and gas resources). Thus the RFD does not provide a basis for site specific discussion of environmental consequences. Recall that at the first level of our analysis, we are deciding whether areas are available and authorized for lease. That means we must have considered the hypothetical siting of a well hole and access on each Affected Environment and we must have considered the environmental effects.

The RFD does offer some indication of spacing for the purpose of doing the site specific analysis. Other than that, the RFD is divorced from this site specific analysis. Our decision for a given area consists of considering the typical activities associated with exploration, access and siting, and developing oil and/or gas resources on that area. (Typical activities are described in detail in Appendix G.) It is this description coupled with the specific *Affected Environments* which is the basis for the discussion of environmental effects of lease options in the first phase of the analysis (documented on pages IV-1 to IV-38 of Chapter IV).

Consideration of the RFD at the Forest Program level is discussed in appropriate detail at the second phase of the analysis (pages IV-39 to IV-86 of Chapter IV).

Forest Plan Amendments

Existing Forest Plan direction for oil and gas leasing, exploration and development activities is in Appendix H. This direction is inadequate to implement the Leasing Reform Act. As a result of the *Leasing Analysis*, changes to Forest Plan direction have been proposed, and are listed in Appendix H.

When a change to the Forest Plan is needed the Forest Supervisor will prepare an amendment and conduct an environmental analysis. Non-significant amendments may be approved by the Forest Supervisor. Significant amendments must be approved by the Regional Forester, and the development and approval of a significant amendment must follow the same procedures as were required for developing and approving the current Forest Plan. "Significance" is defined, in this case, by the National Forest Management Act regulations, and is different than "significance" as defined by the National Environmental Policy Act.

The Forest Supervisor may amend, or recommend to amend the Forest Plan at any time. An amendment may result from:

1. Recommendations of an interdisciplinary team, based on the results of monitoring and evaluation.

2. Decisions by the Forest Supervisor that existing or proposed permits, contracts, cooperative agreements, or other instruments authorizing occupancy and use are appropriate, but are not consistent with the Forest Plan.

3. Changes in proposed implementation schedules, resulting from differences between Forest Plan projected funding levels and actual funds appropriated.

4. Administrative appeal decisions.

5. Planning errors found during plan implementation.

6. Changes in physical, biological, social, or economic conditions.

7. Implementation of new legislation.

The information and decisions disclosed in this document and Record of Decision will be incorporated into the Land and Resource Management Plan for the Grand Mesa, Uncompahgre, and Gunnison National Forests, as an amendment to the Plan. The time period the decisions will be in effect, and processes for review, revision, implementation, and monitoring will be identified.

Issue Identification

Public Involvement and Scoping

The Forest Service invited written comments concerning this *Leasing Analysis* in a Notice of Intent to Prepare an Environmental Impact Statement, published in the Federal Register, Volume 55, No. 207, Thursday, October 25, 1990. The Notice of Intent also announced an open house to be held November 14, 1990 in Montrose, Colorado.

The Montrose open house and two other meetings were announced in the Montrose Daily Press, the Grand Junction Sentinel, and the Delta County Independent. Meetings were held in Montrose on November 14, 1990; in Paonia, Colorado on November 28, 1990; and in Grand Junction, Colorado on December 5, 1990. In addition to the public meetings, a meeting was held with the Delta County Commissioners on December 17, 1990. A second round of open house meetings was conducted April 7, 8 and 9, 1992, in Grand Junction, Paonia and Montrose, Colorado.

The Forest received a total of 20 letters from various members of the public, industry, and environmental groups.

Additionally, informal meetings to discuss the progress of the EIS, our analysis process, and issues were held with representatives of the Colorado Environmental Coalition and the Colorado Mountain Club, on February 20, 1992, and with representatives of the Rocky Mountain Oil and Gas Association and the Independent Petroleum Association of Mountain States, on February 21, 1992. Both meetings were in Denver, Colorado.

To perform the environmental analyses for the leasing decisions, an interdisciplinary (ID) team was assembled. The core team includes a soil scientist, a wildlife biologist, a landscape architect, a transportation planner (engineer), an oil and gas leasing specialist, and a geologist. Other specialists involved in the process includes a fisheries biologist, a range conservationist, a forester, a hydrologist, and a sociologist/economist.

The ID team reviewed literature associated with oil and gas exploration and production and with environmental impacts of these activities. They visited oil and gas drilling, production, and reclamation activities currently taking place on the Forest, and consulted with experts in the BLM, the Colorado Division of Wildlife, the U.S. Fish and Wildlife Service, and other Federal and State agencies. They also consulted with the public to learn about possible environmental, social and economic issues associated with such activities. Finally, they identified and mapped the environmental characteristics of the NFS lands to learn how these lands might be affected by these activities.

The DEIS was published in August, 1992. Four open houses were held September 2, 3, 8 and 10, 1992, in Grand Junction, Paonia, Denver and Montrose, respectively, to discuss the DEIS with

interested publics. Forest Service representatives met with members of Western Colorado Congress, September 16, 1992, in Montrose. The Forest Rescue group in Crested Butte, Colorado, requested that Forest Service representatives speak at their meeting September 24, 1992.

The public comment period extended from August 17, 1992 through October 13, 1992. The Forest received 270 letters from various individuals, industry, environmental groups, local, State and Federal agencies. Comments and responses can be found in Chapter VI.

These various background study activities are termed *scoping* in NEPA procedural regulations. These scoping activities were conducted to help identify the elements of the environment likely to be affected by the leasing decisions, determine what the significant environmental issues are associated with these decisions, and to determine what information and analyses are needed to make these decisions.

Consultation with Other Agencies

The Bureau of Land Management (BLM), as a cooperating agency, provided expertise in the areas of oil and gas operations, geology and groundwater, geographic information systems (GIS), and provided the Reasonably Foreseeable Development Scenario (RFD). Montrose District Office (BLM) personnel were consulted on a regular basis and attended some of the interdisciplinary team and management team meetings.

The Colorado Division of Wildlife (CDOW) was contacted for information and recommendations on wildlife "critical habitats" and other concerns related to the potential effects on wildlife as a result of oil and gas activities. A meeting with representatives of the CDOW was held on May 19, 1992 to discuss their concerns with the potential for oil and gas activity on the various wildlife ranges on the Forest. They also provided their wildlife inventories for inclusion and analysis in the BLM geographic information system.

The Routt and White River National Forests are also in the process of conducting oil and gas *Leasing Analyses*. Meetings were held with them to discuss consistency in the application of stipulations across Forest boundaries. The meetings were held in Glenwood Springs, Colorado on February 11 and 26, 1992; in Montrose, Colorado on November 9, 1992; in Rifle, Colorado on January 6, 1993; and again in Glenwood Springs on January 12, 1993.

Issues

The scoping process helped to identify the issues involved in oil and gas leasing activities. The responses from the public, along with concerns of the ID team discussed during scoping meetings were used to formulate and define the pertinent issues. Note that some of the issues listed below are related to other issues. For example, the issue of road, pipeline, and drilling pad construction is closely related to the issues of wildlife and wildlife habitat, water quality, visual resources, and unroaded areas. The issues are listed below by category. Issues identified by the public and/or other agencies are noted with an asterisk.

Wildlife, Fisheries, and Range Issues

1. What would be the effect of oil and gas activities (disturbance - a greater human presence) on wildlife? *

2. How would wildlife security cover be affected?

3. What would be the effect on wildlife and fisheries sensitive areas?

4. What are the potential cumulative effects on wildlife and fisheries as a result of oil and gas activities? *

5. What would be the impact of road construction on deer, elk, raptors and other wildlife? What would be the effect of reduced forage from road and well pad construction on wildlife? *

6. What would be the effect on poaching levels (especially of T & E species) from oil and gas activities?

7. What timing restrictions for the protection of wildlife would be required?

8. What would be the effect of oil and gas activities on deer, elk, and other wildlife winter range? *

9. What would be the effect on fur-bearers (potential increase in trapping due to increased access opportunities)?

10. What would be the effect on animal numbers? What would be the effect on wildlife habitat (some components of habitat are listed above as separate issues)?

11. What would be the effect on the fishery? What would be the effect on fish numbers?

12. What would be the effect on old growth habitats? (Plant and animal)

13. What would be the effect on biodiversity? (Plant and animal)

14. What would be the effect on threatened, endangered and sensitive wildlife, fish and plant species and critical habitat for those species? Since there is a lack of an adequate inventory on the Forest, how can we adequately address this issue? *

15. What would be the effect of increased road levels on livestock movement and accessibility to additional forage?

16. How would the spread of noxious weeds be affected by oil and gas operations? How would the spread of noxious weeds be controlled?

Recreation Issues

1. What would be the effect on hunting and fishing qualities?

2. How would developed and dispersed recreational use and aesthetics be affected?

3. How would Wilderness and lands with "wilderness qualities" be affected? *

4. What would be the effect on existing undeveloped areas with primitive access (areas without a road system) i.e., what would be the impacts of new roaded access? *

5. What would be the effect on the Roadless Areas as identified in the Forest Plan? What would be the effect on Roadless Areas as identified in RARE II? What would be the effect on solitude in those undeveloped/Roadless Areas? *

6. What would be the effect on developed recreation sites and along public highways?*

7. What would be the effect on Scenic Byways? *

8. What would be the effect on Research Natural Areas? *

9. What would be the effect on recreational qualities, i.e., sights, sounds, smells, etc.? What would be the effect on recreational experiences?

10. What would be the effect on the Recreation Opportunity Spectrum (ROS) character from oil and gas activities? Can access be provided while maintaining the semi-primitive non-motorized (SPNM) ROS experience? i.e., is oil and gas exploration and development compatible with semi-primitive recreation values and opportunities? *

11. What would be the effect on recreation users with increased industrial traffic on the road system?

12. What would be the effect on outfitters and guides and other permitted special uses?

13. What would be the effect on wild and scenic rivers? (Note that East River and Taylor River were identified as potential wild and scenic, but were determined not eligible - see page II-27 of the Forest Plan amendment.)

14. What would be the direct and cumulative effects on visual resources? What would be the effect on the visual quality of Grand Mesa as viewed from below (Grand Junction and public highways)? What would be the affect on the visual quality along the Kebler Pass road?

15. What would be the effect on trails, trail heads, and special areas?

16. What would be the impacts to the Curecanti National Recreation Area and Black Canyon National Monument?

Watershed Issues

1. What would be the effect of oil and gas activities on municipal watersheds? *

2. Would cumulative watershed effects occur? * (How can we model watershed cumulative effects?)

3. What reclamation standards would be applied? What is the capability of the land for revegetation?

4. What would be the effect on surface and groundwater quality and quantity (yield)?

5. What would be the effect on sediment yield? What would be the effect on the soil resource? How much soil would be displaced?

6. Assuming increased sedimentation from oil and gas activities what would be the effect on the life expectancy of the Paonia Dam? *

7. What would be the effect on slope stability and geologic hazards?

8. What would be the effect on riparian areas, floodplains, and wetlands? *

9. What would be the effect of hazardous material accidents/spills? *

10. Do Best Management Practices (BMP's) cover O & G operations? The R2 BMP's are in the draft stage.

Management/Administration Issues

1. How would the EIS be tiered to the Forest Plan?

   a. standards and guidelines

   b. management areas

   c. suited timberlands

   d. grazing levels

   e. recreation and wildlife operation and maintenance funds

   f. Forest-wide O & G standards and guidelines

2. How will the Forest Plan be amended?

3. How will the EIS relate to the Regional guide? (the Forest Plan amendment is under the old guide)

4. How much control does the Forest Service have over future development? Can we limit the number of wells/development?

5. Are current management prescriptions appropriate? Do we need an oil and gas prescription?

6. Is there consistency in our dealings, practices and standards with the O & G and timber industries? For example, do we allow oil and gas operations on a parcel of land that is not suited for timber production?

7. What would be the effect on Forest Service workloads considering current funding levels?

8. Under what circumstances will the FS grant an exception, modification, or waiver to a stipulation? *

9. Will and do we need to be consistent with adjacent forests and the BLM in our stipulations and standards and guidelines?

10. What would be the effect of our stipulations and standards and guidelines on industries ability to explore, develop and produce oil and gas? *

11. How will we manage areas of low, moderate, high and unknown potential for oil and gas? *

12. To what extent should we identify mitigation measures rather than use of lease stipulations to achieve the desired resource protection? *

Road Issues

(Road related issues are also discussed under watershed, recreation, and wildlife, fisheries and range issues.)

1. What would be the loss in suitable timber and/or range land due to road and well pad construction?

2. What would be the loss of forage with road and well pad construction?

3. Who pays and how much do they pay for road maintenance on roads with mixed industrial use (timber and oil and gas)?

4. What road standards would be needed for an oil and gas transportation system? The "gold" book (Surface Operating Standards for Oil and Gas Exploration and Development) has guidelines for roads and access ways. Do we need to vary from these published standards?

5. What would be the effect on road maintenance costs to the counties (and the Forest Service) due to increased traffic levels?.

6. How would the road systems be managed?

7. How would the construction of roads affect timber suitability? Road access may change some previously unsuitable timber land to suitable. There would be an opportunity to add to the Forest's timber base.

8. What would be the potential conflicts between special uses of the Forest for utility corridors and oil and gas leasing? Would/could powerline roads be used for access?

Socioeconomic Issues

1. What would be the effect on tourism?

2. What would be the effect on the local, regional and State economies?

3. Would jobs be created?

4. How much revenue would be generated from oil and gas leasing? How much royalty money would be generated for the Federal treasury and local governments (the treasury would receive 1/8 share of value)? Would energy impact monies be available? What would be the effect on property taxes?

5. What is the demand for oil and gas resources? *

Oil and Gas Operations Issues

1. What, if any, time constraints would/could be placed on servicing new and existing wells? (timing during the day)

2. What is the potential for "blow-out" and what effects would occur on the surface and in the subsurface?

3. What would be the sources and effects of increased noise levels (short and long term)? Compressors, traffic, etc..

4. What would be the potential for hazards to the public from proposed oil and gas leasing and development? Hazards include fire, industrial activity, hazardous materials (hydrogen sulfide gases, etc.), and increased industrial traffic. What is the potential for an oil or gas well fire? Who would suppress such a fire and how would it be suppressed?

5. How would on-site waste disposal be handled? What sanitary facilities would be required? How would litter be controlled?

6. What type of reserve pit system (open or closed) would be used?

7. What would be the effect of oil and gas leases on lands previously leased for coal?

8. Would subsidence occur as a result of the removal of oil and gas resources?

9. What standards for pipeline location would be required?

Miscellaneous Issues

1. What would be the effect on air quality from dust and potential releases of carbon dioxide, sulfur dioxide, hydrogen sulfide, and methane? Can and should we address the global warming issue?

2. How much timber would be harvested? What would be the effect on aspen stands from a visual and recreational perspective?

3. What would be the rate and density of development as estimated by the Reasonably Foreseeable Development (RFD) scenario?

4. What would be the effect on cultural resources?

5. What would be the effect on FS administrative sites?

The following issues will be addressed at the APD (project level) stage:

1. Buffers around specific campgrounds.

2. Old-growth/biodiversity will be tiered to the Forest Plan (if we can do this and still address the issues).

3. Road use issues on specific roads.

4. Timing restrictions on specific roads.

5. Specifics of waste disposal .

6. Road use conflicts on specific roads.

7. Closures of specific roads.

8. Subsidence as a result of removal of oil and gas resources.

9. Quantification of soil loss/displacement.

The Major Issues

The ID team identified five major issues. These issues will be used to compare the effects that implementation of an alternative will have on the environment relative to that of another alternative. They are:

1. Slope stability and geologic hazards.

2. Roadless and undeveloped areas.

3. Wildlife and wildlife habitat.

4. Recreational activities and experiences.

5. Cumulative impacts to wildlife, fisheries, watershed values, timber and oil and gas resources.

Chapter II - Alternatives

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Chapter II - Alternatives

Introduction

This chapter is the heart of the FEIS. This chapter includes a description of the analysis process essential to understanding the rest of the document. Lease options are described, as are the five program-level alternatives and mitigation associated with each alternative. The last part of the chapter is a summary comparison of alternatives, including both a comparison of lease options and of program alternatives.

Activities and Assumptions Relating to Oil and Gas Development

Typical Oil and Gas Activities

An understanding of what activities are associated with oil and gas exploration and development is key to anticipating their impacts. Table II-1 is a brief summary of the sequence of activities associated with oil and gas development, as described in Appendix G. Included are some statistics relating to the amount and duration of actual disturbance at each stage of development. Appendix G includes two more detailed descriptions of oil and gas development. The first part is a description of the environment from the perspective of a forest visitor. The second part is a technical description of all associated activities.

Analysis Assumptions

Analysis assumptions were developed for use in determining the scope of the environmental consequences of oil and gas development activities. The assumptions were developed to describe the effects of the RFD by using data from past oil and gas activities on the Grand Mesa, Uncompahgre and Gunnison National Forests along with guidelines issued in the "Surface Operating Standards for Oil and Gas Exploration and Development--Gold Book" publication.

Assumptions For Any Oil and Gas Lease

1. An oil and gas lease grants a right to the lessee to explore, develop, extract and dispose of oil and gas within the lease area subject to the terms, conditions, and stipulations attached to the lease. Somewhere within the lease area the lessee may exercise this right unless *No Surface Occupancy (NSO)* is a stipulation of the lease. With *NSO*, the lessee still has a right to extract the oil and gas, but may not occupy the surface of the leasehold to do so.

TABLE II-1. SEQUENCE OF EVENTS IN OIL AND GAS DEVELOPMENT

	EXPLORATORY DRILLING	DEVELOPMENT	PRODUCTION		ABANDONMENT
TYPE	WILDCAT	OIL & GAS	OIL	GAS (Natural Gas, Coal Bed Methane, CO_2)	OIL & GAS
PURPOSE	Locate oil & gas reserves	Produce oil and gas	Produce oil	Produce gas	Reclaim area
WELL SITE	2-4 ac. pad cleared and leveled, mud pit, mud pumps, diesel engines, pipe rack, tool house, water storage tanks (5000-15,000 gal/day), fuel storage tanks*, 200'x200' staging area*, rig moved in in pieces on rigs up to GVW 80,000 lb., earthmoving equipment.	-Initial drilling same as Wildcat well site -If well productive, remove large rig and use smaller rig to complete drilling -Productive well site same as described to right	1 ac. pad cleared and leveled, pumpjack, surface/buried pipeline 4-6" dia., oil storage tanks*, water separation tanks/pits*	1 ac. pad cleared and leveled, valve/gauge ("Christmas tree"), surface/buried pipeline: 2-4" dia. flowline, 6-8" dia. trunk line, 10-36" dia. transmission line, Oil & water separation and storage tanks.	Plug well bore hole - different requirements re: rock formation, subsurface water, etc. Cement cap on well, marked with monument stating location, lease #, operator, name of well. Surface equipment removed. Subsurface pipelines plugged at intervals.
ROADS	Construct/reconstruct roads to standard: Arterial 20-24'wide Local 14-18'wide (clearing depends on slope) Past Averages: Reconstruction 0.6 mi./well New Construction 0.7 mi./well				Close, contour, revegetate non-system roads. May occur concurrently with development and production as individual well sites are abandoned.
DEPTH	2000+ feet				N/A
TIME	2 weeks - several months	15-25 years	15-25 years	15-40 years	As non-system roads and well sites are abandoned.
ACTIVITY	Engine noise on site during drilling - audible up to 1-2 mi.; dust generated if air cooled drilling; traffic associated with personnel, water and rig transport - Ave. 13 vpd**/well.Activity varies with level of development and production.	See discussions for exploratory and production activities.	Traffic from tankers accessing wells to transport oil. Traffic from personnel maintaining/ monitoring production - Ave. 2 vpd**/well. Up to 1 well/40 ac. or 1-16 wells/section	Traffic from personnel maintaining/ monitoring production - Ave. 2 vpd**/well Up to 1 well/80 ac. or 2-8 wells/section.	Truck mounted equipment used to plug wells. Dozers/graders present during contouring activities. Sites normally fenced after reseeding to allow regeneration.
RECLAMATION	Contour and revegetate pad and non-system roads.	Contour, revegetate pad and non-system roads. Partial reclamation may occur during development.	Contour, revegetate as needed. Partial reclamation may occur during production		Contour, revegetate as needed.

* May not be present on site, or may be separate site with common facilities for several wells.

** vpd = vehicle per day.

2. Waivers, exceptions, or modifications of stipulations may be allowed when it can be demonstrated that circumstances which required the original stipulation have changed. To modify, waive, or grant exceptions to lease stipulations, the authorized forest officer shall ensure compliance with NEPA and any other applicable laws. The types of potential circumstances that would allow waivers, exceptions, or modifications are identified in Chapter I, page I-16.

3. Crossing riparian areas, wetlands, and areas of high geologic hazard may be unavoidable in some cases to access a well site. However, activity in these areas is subject to prior approval in a Surface Use Plan of Operations. Mitigation measures will be applied to protect these resources.

4. *Standard Lease Terms* allow road, well pad, and pipeline construction on the leasehold, but are subject to reasonable restrictions to protect surface resources and uses.

Assumptions on the Forest for Direct and Indirect Effects

(Assumptions were developed based on the Reasonably Foreseeable Development scenario [See Appendix E] and past oil and gas activities on the Forest.)

5. The Reasonably Foreseeable Development scenario is the basis of the analysis. Natural gas is the resource most likely to occur. Coal bed methane is not expected to be developed because tax incentives have not been extended and the associated water production increases costs to produce methane.

6. The life expectancy of a wildcat well (a wildcat well is an exploration well) that does not produce is one year (from drilling to abandonment). Abandonment means plugging the hole, restoring the topsoil, and re-seeding the area in accordance with requirements of the surface management agency and Onshore Order #2. Revegetation is expected to be successful in three growing seasons following abandonment.

7. If a wildcat well results in a producer, the average life expectancy of the well is 40 years. Revegetation is expected to be successful within three growing seasons following abandonment.

8. The well spacing will average three wells per section in a fully developed field.

9. Road construction and reconstruction will meet applicable Forest Service Manual and Forest Plan direction for protecting all resource values.

10. Roads constructed for oil and gas development may be closed to general public use, depending on the *Affected Environment* in which oil and gas activity occurs.

11. Oil and saltwater leaks/spills will occur at unpredictable intervals. All areas disturbed by leaks/spill will be reclaimed and revegetated.

12a. A typical well will require one mile of new road construction affecting an average of 4.2 acres/mile (assuming a 35 foot right of way).

12b. A typical well will require one mile of road reconstruction affecting an average of 2.1 acres/mile (assuming that 1/2 of the right of way was already disturbed; therefore, use 17.5 feet of new disturbance for acreage calculations).

12c. A typical well will require a level pad size of 300 feet by 300 feet with 1 1/2:1 cutslopes and fillslopes. Based on a 20% average slope, the disturbed area will be 3.5 acres/well.

12d. Pipelines will normally be located in the road corridor, causing no additional disturbance; however, occasional cross-country sections will be necessary. Based on past oil and gas development on the Forests, a typical well will result in approximately 0.2 miles of pipeline, or 0.9 acres additional clearing will be needed for pipelines.

A typical well will disturb a total of 10.7 acres.

13. Drilling activity within the Forest will continue at the same conservative levels of 1986 to 1990, and constitute about 3% of the regional activity.

14. Projected well distribution throughout the analysis area is:

Grand Mesa National Forest - 12 wells; Six of which will be completed for production. Seven of the 12 wells will be in high potential and five will be located in the moderate potential areas. Eight of the 12 wells will be drilled on existing leases. Four of the 12 wells will be drilled on new leases.

Gunnison National Forest - 12 wells; Six of which will be completed for production. All of these wells will be located in high potential areas. Two of these wells are expected on Petro-Energy's existing lease C-30465. Two wells will be drilled on new leases.

Uncompahgre National Forest - 3 wells; One of which will be completed for production. All three of these wells will be located in the high potential areas and one of them will be on new leases.

Areas under Unit Agreements - 20 wells. There are two exploratory units with predicted activity within the analysis area. A 90% success rate is projected in these units. The units with projected activity are listed below:

(1) Narrows - Gunnison National Forest - 10 wells.

(2) Ragged Mountain - Gunnison National Forest - 10 wells.

The total number of projected wells over the next 15 years on the Forest is 47.

Forty-two (42) of the projected wells will be drilled in areas of high potential for oil and gas resources. Five will be drilled in moderate potential.

Of the 47 wells predicted to be drilled over the next 15 years, 40 are expected on existing leases. **Only 7 wells are predicted to be drilled on new leases.** The number of wells drilled for each alternative will remain the same (except for the *No Lease* alternative):

TABLE II-2. COMPARISON OF PREDICTED NUMBER OF WELLS FOR EACH ALTERNATIVE					
NUMBER OF WELLS	**ALT. 1**	**ALT. 2**	**ALT. 3**	**ALT. 4**	**ALT. 5**
Within New Leases	7	7	0	7	7
Within Existing Leases	20	20	20	20	20
Within Existing Units	20	20	20	20	20
TOTAL	47	47	40	47	47

The number of wells drilled on existing leases (not subject to the decisions made in this EIS until the lease expires, is relinquished, or is terminated) is constant. Also, the number of wells drilled on new leases is the same with the exception of Alternative 3 - No Lease. Assume that the location of the 7 wells on new leases will shift to those areas where the stipulations are less restrictive by alternative.

15. The total number of acres disturbed from oil and gas development activity over the next 15 years is projected to be 503 acres of which about 54 acres is projected for the areas of moderate potential for oil and gas resources with the remaining acreage in areas of high potential. The distribution of these acres throughout the Forest and units is:

TABLE II-3. COMPARISON OF TOTAL NUMBER OF ACRES DISTURBED FOR EACH ALTERNATIVE

ACRES DISTURBED	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5
Grand Mesa N.F.					
New Leases	43	43	0	43	43
Existing Leases	86	86	86	86	86
Gunnison N.F.					
New Leases	21	21	0	21	21
Existing Leases	107	107	107	107	107
Existing Units					
Narrows	107	107	107	107	107
Ragged Mtn.	107	107	107	107	107
Uncompahgre N.F.					
New Leases	11	11	0	11	11
Existing Leases	21	21	21	21	21
TOTAL	503	503	428	503	503

Total projected disturbance is estimated to be 503 acres

16. Of the 27 wells to be drilled outside of units, 13 are projected to be completed for production. The remaining 14 will be reclaimed.

A 90% success rate is estimated for the 20 wells projected to be drilled in the 2 areas under unit agreements. 18 wells will be completed for production. The 10% (2 wells) which do not produce will be reclaimed.

The production wells will undergo interim reclamation within a year of completion. A 150 foot by 150 foot level pad is assumed to be left for production activities. This amounts to 0.9 acres as opposed to the original 3.5 acres/well of disturbed area; leaving 2.6 acres/well to reclaim.

Reclamation acreages for well pads are:

Total reclamation for 16 wells @ 3.5 acres/well = 56 acres

Interim reclamation for 31 producer wells @ 2.6 acres/well = 81 acres.

Road reclamation is assumed based on new road construction only. Roads to unsuccessful holes will be reclaimed. Reconstructed roads will not generally be

reclaimed. At 4.2 acres/mile of road, the 16 unsuccessful wells would account for 67 acres of road to reclaim.

Total reclamation of 0.9 acres/well for pipelines on 31 wells is 28 acres.

17. Total long term disturbance is projected to be:

TABLE II-4. TOTAL LONG TERM DISTURBANCE		
Total Acres Disturbed		503
Total Well Pad Reclamation	56	
Interim Well Pad Reclamation	81	
Road Reclamation	67	
Pipeline Reclamation	28	
Sub-total Reclamation Acres	232	-232
Long Term Acres Disturbed		271

The long term disturbance is the total projected disturbance (503) less the total acres reclaimed (232) for a total of 271 acres.

Connected Actions

In selected areas, oil and gas development is likely to lead to additional activities which also need to be considered in making a decision to allow or not allow such development. These are connected actions, which although not a part of the original purpose for development, may reasonably follow as a result of the development.

In the case of oil and gas development the greatest opportunity for this kind of cause and effect is in the development of roads into areas which are not now roaded. This could provide access to timber stands which would otherwise be uneconomical to reach. This in turn provides the opportunity to harvest more timber than would otherwise occur. For the purpose of the analysis here, these areas are represented as areas coded in the Forest Plan (Table II-18 on page II-52 and Table F-2 on page F-3) as "3 - High Road Cost/Access".

The assumption built into this analysis is that, if accessed, these areas would become a part of the suited timber base and some average level of timber harvesting would take place. It is not possible to predict the exact amount of harvest that would occur without conducting analysis that is well outside the scope of this Oil and Gas Leasing Analysis FEIS. Analysis of possible consequences sufficient to make the decisions at hand is possible assuming harvesting levels represented by other parts of the suited timber base.

Past practices are a good indication of activities which could be expected. Typically, in the first entry into unharvested aspen forests, 20 to 25 percent of the area is clear-cut. In conifer stands single tree and group selection harvest is practiced over larger treatment areas, typically covering as much as 50 percent of the area, in the first entry. These harvest amounts are consistent with Forest Plan standards and guidelines. An analysis of the environmental consequences of timber harvesting is provided in Chapter IV of the FSEIS for the Amendment of the Land and Resource Management Plan, Grand Mesa, Uncompahgre and Gunnison National Forests.

In Chapter IV, Environmental Consequences, for those *Affected Environments* where the harvest of additional timber is a possible result of developed access, the consequences to other resources of such activities are discussed. These "3 - High Road Cost/Access" areas unsuited for timber harvest are discussed in the General Forest, Roadless, and 3A Semi-primitive Non-motorized *Affected Environments*.

Timber management activities in areas considered "3-High Road Cost/Access" could result in a slight increase in the Forest's Allowable Sale Quantity (ASQ). This FEIS and the decisions associated with it are not the place to address the specific decision to amend the Forest Plan ASQ. That would take place in the event of actual development of the access described above as hypothetical. Should this development take place, the amendment of the Forest Plan would be considered following appropriate procedures under the National Forest Management Act (NFMA) for doing so. Further, before any timber harvest could take place in these areas additional site specific environmental analysis following appropriate procedures under the National Environmental Policy Act (NEPA) would be conducted, resulting in specific timber management decisions.

Descriptions of Alternatives

In keeping with the two-tiered analysis process described above, alternatives consist of combinations of Lease Options on various *Affected Environments*. The five lease options are listed below. Next, the Forest program alternatives (1 through 5) are described (Table II-5). Last, those conditions that are common to all alternatives in terms of common mitigation and/or common direction from the Forest Plan are described.

Lease Options (First Level Analysis and Decisions)

The five lease options are listed below:

- No Lease (NL)
- No Surface Occupancy (NSO)
- Controlled Surface Use (CSU)
- Timing Limitations (TL)
- Standard Lease Terms (SLT)

With the exception of *No Lease*, these have already been described in some detail in Chapter I. You should refer to pages I-15 through I-16 for more information on their meaning and use. An understanding of these lease options is essential to the following analysis.

Program Alternatives (Second Level Analysis and Decision)

Each program alternative represents a unique package of lease option choices for the *Affected Environments* in the analysis area. Table II-5 displays the lease option combinations which make up the five program alternatives considered in this analysis. Each alternative is briefly described in the following pages. Figures II-1 through II-5 (pages II-59 - II-67) are maps of the lease option combinations, by alternative.

TABLE II-5. DISPLAY OF ALTERNATIVES

AFFECTED ENVIRONMENT	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
General Forest	SLT	SLT	NL	SLT	SLT
Floodplains *	CSU	NSO	NL	SLT	NSO
Aquatic/Riparian/Wetland Habitats *	CSU	NSO	NL	SLT	NSO
Alpine/Tundra Areas	CSU	NSO	NL	SLT	NSO
High Geologic Hazard	NSO	NSO	NL	SLT	NSO
Moderate Geologic Hazard	CSU	CSU	NL	SLT	CSU
Roadless Areas:					
- Raggeds	NSO, CSU, TL, SLT	NL,NSO,CSU,TL,SLT	NL	SLT	NL
- Drift Creek	NSO, CSU, TL, SLT	NSO, CSU, TL, SLT	NL	SLT	NL
- Springhouse Park	CSU, TL, SLT	CSU, TL, SLT	NL	SLT	NL
- Electric Mountain	NSO, CSU, SLT	NSO, CSU, SLT	NL	SLT	NL
- Clear Creek	NSO, CSU, TL, SLT	NSO, CSU, TL, SLT	NL	SLT	NL
- Hightower	NSO, CSU, TL, SLT	NSO, CSU, TL	NL	SLT	NL
- Priest Mountain	NSO, CSU, TL, SLT	NL,NSO,CSU,TL,SLT	NL	SLT	NL
- Salt Creek	NSO, CSU, TL, SLT	NSO, CSU, SLT	NL	SLT	NL
- Battlement Mesa	NSO, CSU, TL, SLT	NSO	NL	SLT	NL
- Nick Mountain	NSO, CSU, SLT	NSO, CSU, TL, SLT	NL	SLT	NL
- Kannah Creek	NSO, CSU, TL	NL	NL	SLT	NL
- West Elk	NSO, CSU, TL, SLT	NL, NSO, CSU, SLT	NL	SLT	NL
- Whetstone Mountain	NSO, CSU, SLT	NL	NL	SLT	NL
- Flat Top Mountain	CSU	NL	NL	SLT	NL
- Roubideau	NSO, CSU, TL, SLT	NL	NL	SLT	NL
- Tabeguache	NSO, CSU, TL, SLT	NL	NL	SLT	NL
- Kelso Mesa	NSO, CSU, SLT	NSO, CSU, SLT	NL	SLT	NL
- Campbell Point	CSU, TL	CSU, TL	NL	SLT	NL
- Johnson Creek	NSO, CSU, TL	NSO, CSU, TL	NL	SLT	NL
Research Natural Area	CSU	NL	NL	SLT	NL
Sensitive Areas	CSU	NSO	NL	SLT	NSO
Retention VQO - Low VAC	NSO	NSO	NL	SLT	NSO
Retention VQO	CSU	CSU	NL	SLT	CSU
Scenic Byway Corridors	CSU	CSU	NL	SLT	CSU
Semi-primitive Non-motorized (3A Management Areas)	CSU	NSO	NL	SLT	NL
Administrative Sites *	NSO	NSO	NL	SLT	NSO
Recreation Complexes	CSU	NSO	NL	SLT	NSO
Watersheds of Special Interest to Municipalities	CSU	CSU	NL	SLT	CSU
Slopes 40-60%	CSU	CSU	NL	SLT	CSU
Slopes > 60%	NSO	NSO	NL	SLT	NSO

TABLE II-5. DISPLAY OF ALTERNATIVES

AFFECTED ENVIRONMENT	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Wildlife Special Habitats:					
- Big Game Winter Range	CSU,TL	CSU,TL	NL	SLT	CSU,TL
- Elk Calving Areas	SLT	CSU,TL	NL	SLT	CSU,TL
- Migration Routes & Staging Areas	SLT	CSU,TL	NL	SLT	CSU,TL
- Bighorn Lambing/Breeding Areas	TL,SLT	NSO	NL	SLT	NSO
- Summer Range (Concentrated Use)	SLT	NSO	NL	SLT	NSO
- Sage Grouse Leks	SLT	NSO,CSU,TL	NL	SLT	NSO,CSU,TL
Threatened and Endangered Species *	Threatened and Endangered species are protected under the Endangered Species Act. Protective measures will be taken under all lease options.				
Utility Corridors/ Electronic Sites	NSO	SLT	NL	SLT	SLT
Primary Rangeland (6B Management Areas)	SLT	SLT	NL	SLT	SLT
Lands Suited for Timber Harvest	SLT	SLT	NL	SLT	SLT

* Not displayed on FEIS maps because of sensitivity or size.

NL = No Lease, NSO = No Surface Occupancy, CSU = Controlled Surface Use, TL = Timing Limitations, SLT = Standard Lease Terms

Table II-6 summarizes by alternative, the acres of each lease option.

TABLE II-6. ACRES OF LEASE OPTIONS BY ALTERNATIVE**

LEASE OPTIONS	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Acres*	%	Acres*	%	Acres*	%	Acres*	%	Acres*	%
No Lease (NL)	0	0	138,270	15	951,450	100	0	0	349,150	37
No Surface Occupancy (NSO)	58,400	6	151,835	16	0	0	0	0	78,350	8
Controlled Surface Use (CSU)	463,600	49	215,170	23	0	0	0	0	130,250	14
Controlled Surface Use & Timing Limitations	202,350	21	239,755	25	0	0	0	0	202,950	21
Timing Limitations (TL)	81,600	9	80,440	8	0	0	0	0	77,950	8
Standard Lease Terms (SLT)	145,500	15	125,980	13	0	0	951,450	100	112,800	12

* Analysis area = 951,450 acres. ** Acreages do not reflect existing leases.

Alternative 1 - No Action

The No Action alternative is required by NEPA regulations. The No Action alternative is "*current management in accordance with the Forest Plan*". The Forest Plan specifies different lease stipulations for the different *Affected Environments*. Table II-5 displays the lease stipulations specified by the current Forest Plan for each of the Affected Environments. (See Appendix H for current Forest Plan direction.)

The Forest Plan does not specifically address all the *Affected Environments* as delineated in this FEIS. Some interpretation of the Forest Plan was necessary to determine which stipulation may apply to a specific *Affected Environment*. The Forest Plan says "Recommend against or deny consent to the BLM for issuance of leases where operational damages on surface resources... would be irreversible or irretrievable, with no potential for reclamation". The Forest Plan bases no lease recommendations to the BLM on the site specific consideration of the following criteria:

- Slopes steeper than 60 percent.

- High erosion hazard soil ratings.

- High geologic hazard ratings.

- Low visual absorption capacity that prevents reclamation to established visual quality objectives.

- A conclusion by the Forest Service (FS) and/or the U.S. Fish and Wildlife Service (USFWS) that the action will jeopardize the survival or recovery of Federally listed threatened and endangered (T&E) wildlife or plant species.

- Intrusion upon the identified critical (USFWS) or essential (FS) habitat of a Federally listed (T&E) wildlife or plant species or upon the plant or animal itself.

- Intrusion upon the habitat of individual plant or animal species listed by a State as threatened or endangered.

- Intrusion upon the habitat of individual plant or animal species identified by the Regional Forester as needing special management to prevent the need for listing it as a threatened or endangered species.

With this alternative, all of the analysis area would be available for oil and gas leasing. Floodplains, Alpine/Tundra, Research Natural Areas, Sensitive Areas, Retention VQO, Scenic Byway Corridors, 3A Management Areas, Recreation Complexes (dispersed and developed sites), Watershed of Special Interest to Municipalities, and Slopes 40-60% would have *Controlled Surface Use* stipulations attached to the lease. See Figure II-1 for reduced scale map showing stipulations under this alternative.

Alternative 2 - Preferred

This alternative does not authorize leasing of some of the legally available land in the analysis area. Those areas with discretionary *No Lease* include the Kannah Creek, Tabeguache, and Roubideau Roadless Areas. These Roadless Areas have been mentioned in recent Wilderness legislation. Additionally the proposed Tabeguache Research Natural Area, Whetstone Mountain, Flat Top Mountain, and parts of West Elk (Snowshoe Mesa, Kebler Pass), Raggeds (Kebler Pass) and Priest Mountain (Flat Tops, et al.) Roadless Areas would not be available for leasing.

The Battlement Mesa Roadless Area would be leased, but with *No Surface Occupancy* stipulations. Other resource concerns within Roadless Areas may effectively protect some of the roadless values, i.e., Slopes over 60% in Roadless Areas would have the *No Surface Occupancy* stipulation attached to the lease.

Areas protected with *No Surface Occupancy* under this alternative include: Sensitive Areas, Alpine/Tundra, Floodplains, areas of Retention VQO and Low VAC, Semi-primitive Non-motorized (3A Management Areas), Recreation Complexes (developed and dispersed sites), Administrative Sites, Slopes over 60%, Bighorn Sheep Lambing and Breeding Areas, and Sage Grouse Leks.

Resources protected with *Timing Limitations* and *Controlled Surface Use* stipulations include: areas with Moderate Geologic Hazards, Retention VQO, Scenic Byway Corridors, major ski trails, Slopes 40-60%, and the nesting area around a Sage Grouse Lek.

The option (the decision maker has) chosen for each of the *Affected Environments* is displayed in Table II-5. (See Figure II-2 and large stipulation map.)

Alternative 3 - No Lease

With the selection of this alternative, none of the Forest would be administratively available for oil and gas leasing. The Forest would not authorize the BLM to lease the oil and gas resources underlying the Forest. The selection of this alternative would not affect existing leases. However, should an existing lease expire, the parcel would not be available for future leasing. This alternative, since it represents

the least potential for ground disturbance, also constitutes the environmentally preferred alternative. Note also, that even if this alternative is chosen, environmental consequences may still occur from those activities on existing leaseholds.

This alternative is required by the Forest Service oil and gas regulations (36 CFR 228.102(c)(2)). This alternative represents the most restrictive alternative to the oil and gas industry. (See Figure II-3.)

Alternative 4 - Lease with Standard Lease Terms

With the selection of this alternative, all legally available lands would be subject to oil and gas leasing with *Standard Lease Terms*. The Forest would authorize the BLM to offer for lease all unleased Federal oil and gas underlying the Forest, within the analysis area (defined in Chapter I, Lands Involved, pages I-5 - I-7).

This alternative represents the least restrictive alternative to the oil and gas industry. (See Figure II-4.)

Alternative 5 - No Lease in Roadless and SPNM

Roadless Areas and areas with a Semi-primitive Non-motorized ROS as a management prescription (3A) in the Forest Plan, would not be administratively available for oil and gas leasing. The goal of this alternative is to protect the roadless character of Roadless Areas and to maintain the Semi-primitive Non-motorized recreation opportunity on the Forest. Since some of the current Roadless Areas and 3A Management Areas are currently leased, the character of those Roadless Areas may change even if this alternative is chosen.

This alternative is the same as Alternative 2, except in it's treatment of Roadless Areas and 3A Management Areas (Semi-primitive Non-motorized ROS by Forest Plan management prescription). All Roadless Areas and 3A Management Areas would not be available for leasing. If existing leases in Roadless Areas and 3A Management Areas expire or are relinquished, they would not be available for leasing for the life of this EIS. (See Figure II-5.)

Mitigation

Mitigation, and standards and guidelines for oil and gas operations on NFS lands are expressed in Section 6 of the standard lease form (Form 3100-11; Offer to Lease and Lease for Oil and Gas, Appendix B), the BLM regulations at 43 CFR 3101.1-2 Surface Use Rights, the Forest Service oil and gas regulations (36 CFR 228.108), Onshore Oil and Gas Orders, the Forest Plan, the "Gold Book" (Oil and Gas Surface Operating Standards for Oil and Gas Exploration and Development) and Conditions of Approval that will be required prior to approval of the APD. Restrictions on surface use may also be imposed by specific nondiscretionary statutes such as: The Endangered Species Act, the Archaeological Resource Protection Act, the National Historic Preservation Act, the Native American Graves Protection and Repatriation Act, the Clean Water Act, and the Clean Air Act. See Appendix H for a discussion of general mitigation that is common to all alternatives except the No Lease alternative.

Common to all alternatives is the fact that the Forest has existing oil and gas leases. None of the alternatives would change the Forest's currently leased lands. The existing leases, as discussed in Chapter I, would remain in effect with existing terms and stipulations until expiration or relinquishment. None of the alternatives would change the current terms or administration of existing leases. The potential for environmental consequences on the existing leases would not change as a result of implementation of any of the alternatives discussed above. However, if existing leases expire or are relinquished the alternative selected in this analysis will dictate the stipulations that will be applied to the parcel if it is offered for lease in the future.

Comparison of Alternatives

Summary Comparison of Lease Options

The Environmental Consequences of each lease option are compared in the following tables, as they relate to the environmental factors of each *Affected Environment*. A complete discussion of these consequences is in Chapter IV.

Note: The indirect effects of greatest consequence are the effects of timber harvesting introduced by roads built to accommodate oil and gas, but which also access timber stands. These effects are documented in detail in the FSEIS for the Forest Plan Amendment, completed in 1991. Reference is made below to these indirect effects, without going into detail. The reader is referred to the FSEIS.

Potential impacts from oil and gas development could occur on existing leases regardless of lease options.

Mitigations measures listed below are examples and are not all inclusive.

AFFECTED ENVIRONMENT : General Forest
ACRES : 951,450
MAPS : No

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Biological Diversity	No effect from O&G activity.	No effect from O&G activity.*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Temporary loss of biodiversity on sites cleared for pads, roads or pipelines. Diversity of veg. species lost from disturbed areas (revegetation usually uses just a few species) - tree vegetation would be lost for years, replaced by early succession species. Potential for future timber management in areas accessed by new roads would adversely change species diversity - impacts vary with tree species managed.
Vegetation	No effect from O&G activity.	No effect from O&G activity.*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Vegetation removal for pads, roads, pipelines could remove site from wood fiber production. Abandoned drill sites and roads may be restored to tree vegetation over long term.
Soils	No effect from O&G activity. Continued background levels of erosion.	No effect from O&G activity.*	Lessen impacts of Standard Lease Terms through special mitigation (see below).	Same as Standard Lease Terms except the effects during wet seasons would be mitigated.	Displacement and mixing of soils for construction activities, of both roads and drill sites, consequent loss of natural profile, micro-organisms, irreversible loss of productivity of those sites. Soils exposed during road construction would be subject to greatly accelerated erosion rates . Erosion rates should lessen over time as exposed soil stabilizes.
Air Quality	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts with mitigation.	Impacts would be mitigated with timing limitations.	Increased dust from road use and drilling operations would decrease air quality in localized areas

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Water Quality and Quantity	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts of Standard Lease Terms with special mitigation (see below). Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.	Lessen sediment production potential by limiting construction/use to roads and well pads, only in dry soil periods. Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.	Sediment yield from surface disturbance activities/road and well pad use. Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.
Range and Livestock Grazing	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts through placement of O&G developments so existing range developments are not damaged.	Lessen impacts by timing activities when there would be less potential for conflict with livestock movement.	Potential for increased conflict with livestock management by leaving gates open, removing fences, disturbing use patterns. Increased access could provide better trailing routes.
Roads	No effect from O&G activity.	No effect from O&G activity.*	Potential conflicts between public, O&G operators and timber purchasers if activities coincide on adjacent areas. Indirect effects of improved road maintenance, realignment, etc. as result of O&G development.	Potential conflicts between public, O&G operators and timber purchasers if activities coincide on adjacent areas. Indirect effects of improved road maintenance, realignment, etc. as result of O&G development.	Potential conflicts between public, O&G operators and timber purchasers if activities coincide on adjacent areas. Indirect effects of improved road maintenance, realignment, etc. as result of O&G development.
Visual Resources	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts of Standard Lease Terms with special mitigation (see below). Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.	Same as Standard Lease Terms. Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.	Construction of O&G development/production facilities and presence of commercial vehicles associated with the development would not be compatible with partial retention VQO areas. Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.
Recreation Opportunities	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts of Standard Lease Terms with special mitigation (see below); however there would be some reduction in quality of recreation experience in areas where development and operation occur. Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.	Same as Standard Lease Terms. Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.	There may be a change in the existing ROS as development and production activities/facilities occur. Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Cultural and Historical Resources	No effect from O&G activity.	A cultural survey is required before any ground disturbing activities. Any identified cultural resources must be protected by avoidance or excavated and recorded. If any cultural resources are found during construction, they must be protected and reported. (36 CFR 800, EO 11593, National Historic Preservation Act)			
Wildlife	No effect from O&G activity.	No effect from O&G activity.*	Activities could result in displacement of wildlife. Lessen impacts through special mitigation (see below.) Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.	Timing limitations would mitigate some of the impacts during certain critical time periods (birthing, nesting, wintering, courtship), but activities in wildlife summer ranges could result in displacement of wildlife. Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.	Potential for disturbance to wildlife and wildlife habitat with O&G activities could result in decline in habitat carrying capacity (loss of habitat, overuse of habitat by displaced animals), decreased populations and problems on private lands. Roading previously unroaded areas would allow increased human activity (timber sales, hunting) which would further impact wildlife and habitat. Greatest impacts on species with small home ranges. Potential indirect effects from timber harvesting introduced into areas accessed by oil and gas roads.
Wildfire	No effect from O&G activity. Indirect effect - lack of access to areas may hinder suppression.		Same as Standard Lease Terms.	Lessen chance of man-caused fires by restricting uses during high fire danger.	Activity in remote areas may increase chance of man-caused fires. Improved access could aid suppression.
Oil and Gas Resources	Opportunities to explore for, discover and develop O&G resources would be lost. Loss of Federal, State & local revenues.	The operator where possible would have to access O&G resources from outside the area. Drilling would be much more expensive.	The costs of exploration and development would be higher. Potential loss of revenue from bonus bids.	Recovery of O&G resources but with increased costs for the operator.	Lowest costs for O&G activity. Potential increased profit margin or lower costs to the consumer.

* No effect unless stipulation waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Water Quality - Restrict off-road vehicle use (when & where); Maintain buffers between all surface drainage features (specify distance from drainage re: slope, type); Stringent rehabilitation standards (anchored mulch, seed mix, fertilizer, water); Road surface requirements (MgCl, NaCl, asphalt, rock/gravel); Requirements for transport, handling and cleanup of hazardous substances; Minimize well pad size.

Visual Resources - In partial retention VQO areas, only allow drill pad development and use where vegetative or land form screening exist. Require all structures (drill rigs, tanks, valves/Christmas trees, buildings) to be colored to blend with the natural environment.

Recreation Opportunity Spectrum - Protect inventoried SPM areas by limiting drill pad development and roads where directional drilling from adjacent areas is possible.

Wildlife - Restrict road use to operators in previously unroaded areas. Obliterate new roads when work is completed. Avoid critical areas for management indicator species (MIS), i.e. goshawk nests. Design facilities to limit line of sight. Limit new roads in mature ponderosa pine, aspen, or lodgepole/spruce to maintain habitat for MIS, limit chance of future timber sales.

Soils - Restrict motorized traffic to specified drill site and road surfaces.

Air Quality - Dust abatement on access roads.

TIMING LIMITATIONS IN THIS AFFECTED ENVIRONMENT :

Water Quality & Soils - Restrict activities to times when soils are not saturated.

Air Quality - Restrict activities during poor air quality episodes.

OTHER FACTORS TO CONSIDER:

Wildlife - Endangered Species Act provides protection for listed species.

AFFECTED ENVIRONMENT : Floodplains
ACRES : 10,200
MAPS : No

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Vegetation	No effect from O&G activity.	No effect from O&G activity.*	Minimize the potential for impacts through limiting amount and location of disturbance.	Same as Standard Lease Terms.	Potential for loss of plant association due to disturbance.
Soils	No effect from O&G activity.	No effect from O&G activity.*	Minimize the potential for impacts through limiting amount and location of disturbance.	Restricting/ eliminating use during wet soil periods would lessen the potential for sedimentation.	Potential for significant and serious impairment of soil productivity, release of measurable amounts of sediment into active waterways, rutting, puddling, displacement of very sensitive soils.
Water Quality	No effect from O&G activity.	No effect from O&G activity.*	Special mitigation would lessen the potential for impacts of Standard Lease Terms (see below).	Restricting/ eliminating use during wet soil periods would lessen the potential for sedimentation.	Removal of vegetation and soil and gravel during excavation could alter hydrologic function of floodplain. Sediment and toxic spills could enter surface and ground water decreasing quality.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Water Quality - Prohibit gravel removal within floodplain; No well sites or storage facilities within floodplain; Road or pipeline cross area at right angles; See also management direction for 9A (Appendix H, pages H-9 & H-10).

OTHER FACTORS TO CONSIDER:

Activities upstream or on adjacent areas.

E.O. 11988 - Direction to avoid adverse impacts to floodplains (to the extent possible).

Possible point of confusion: Floodplains may extend beyond riparian habitat. These effects deal only with floodplain outside riparian habitat. Forest Service regulations (36 CFR 228.108(j)) do not allow the operator to occupy the surface in riparian areas, unless approved in the SUPO.

AFFECTED ENVIRONMENT : Aquatic/Riparian/Wetland Habitats
ACRES : 27,600
MAPS : No

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Vegetation	No O&G activities would be allowed within these habitats; however, road construction/ stream crossings may be necessary as access is developed for adjacent lands. (See impacts under Standard Lease Terms.)	Most O&G activities would not be allowed within these habitats; however, road construction/ stream crossings may be necessary. (See impacts under Standard Lease Terms.)	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Vegetation would be cleared during construction of roads and stream crossings. Removing vegetation would temporarily eliminate the natural filter which reduces sediment entry into waterways.
Soils	No O&G activities would be allowed within these habitats; however, road construction/ stream crossings may be necessary as access is developed for adjacent lands. (See impacts under Standard Lease Terms.)	Most O&G activities would not be allowed within these habitats; however, road construction/ stream crossings may be necessary. (See impacts under Standard Lease Terms.)	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Potential for impairment of soil productivity, release of measurable amounts of sediment into active waterways, rutting, puddling, compaction, displacement of very sensitive soils.
Water Quality	No O&G activities would be allowed within these habitats; however, road construction/ stream crossings may be necessary as access is developed for adjacent lands. (See impacts under Standard Lease Terms.)	Most O&G activities would not be allowed within these habitats; however, road construction/ stream crossings may be necessary. (See impacts under Standard Lease Terms.)	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Potential for water quality to be negatively impacted as result of increased sediment.
Fisheries & Aquatic Habitat	No O&G activities would be allowed within these habitats; however, road construction/ stream crossings may be necessary as access is developed for adjacent lands. (See impacts under Standard Lease Terms.)	Most O&G activities would not be allowed within these habitats; however, road construction/ stream crossings may be necessary. (See impacts under Standard Lease Terms.)	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Potential for significant impacts to fisheries and aquatic habitat resulting from road construction/ stream crossings. Introduced sediment would impact: macroinvertebrate spp. populations and composition; eliminate spawning habitat; impact fry mortality. Potential for toxic spills occurring on roads to enter water, seriously impacting plant and animal species.

CSU IN THIS AFFECTED ENVIRONMENT :

Delineate specific aquatic/riparian/wetland habitats on ground when the APD is submitted. See management direction for 9A Management Areas, Appendix H pages H-9 and H-10.

OTHER FACTORS TO CONSIDER:

Activities upstream or on adjacent areas. Waste water disposal. Sediment contributed from road/pipeline crossings, road drainage. Toxic spills washed off adjacent roads.

The regulations (36 CFR 228.108(j)) do not allow operations in riparian areas and wetlands unless approved in a SUPO (part of APD process).

Fisheries and Aquatic Habitat - Condition of riparian habitat relates to the severity of impacts from surrounding areas. Cumulative effects of other management activities and their impacts on this habitat must be considered with the impacts of oil and gas activities.

AFFECTED ENVIRONMENT : Alpine/Tundra Area
ACRES : 2100
MAPS : Figure III-5

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Soils	No effect from O&G activity.	No effect from O&G activity.*	Stipulations may reduce or mitigate soil disturbance described under Standard Lease Terms to within acceptable limits, but the severity of accidents is greatly magnified in this environment. Mitigation would be very costly, and in some cases of uncertain success. Stipulations would have no value in mitigating disturbance and mixing of soils with parent material at construction sites of roads and drill sites. Reclamation could only be partial.	Timing Limitations would limit activity to times when soils are least susceptible to disturbance (winter or mid-summer). Soils exposed during these times would be extremely slow to stabilize and would experience significant loss during ensuing rainy and snow melt periods. Timing would have no value in mitigating disturbance and mixing of soils with parent material at construction sites of roads and drill sites. Reclamation could only be partial.	Beyond soil disturbance described in general forest, likelihood of significant permanent soil damage is great. Any disturbance of alpine soils and vegetation is noticeable for hundreds of years. Micro environments are lost and replaced with sterile and erodible surfaces. Slopes are usually steep and erosion rates magnified. Thin soil mantle which has developed over 10,000 years may be lost in one season. This could be due to a range of activities from introduced traffic on the surface, to reshaping and rehabilitation of dry hole drill sites. Chance of single event, catastrophic soil loss events from high elevation severe thunderstorms would be great.
Vegetation	No effect from O&G activity.	No effect from O&G activity.*	Special mitigation measures would lessen the impacts.	No mitigation with timing. Same as Standard Lease Terms.	Disturbed sites are hard to reclaim due to shallow soils, harsh climates, and poor seed sources.
Water Quality	No effect from O&G activity.	No effect from O&G activity.*	Special mitigation would lessen impacts described for Standard Lease Terms (see below).	Timing Limitations would not significantly change potential impacts that would occur under Standard Lease Terms.	Water quality could be decreased as a result of: increased sedimentation from disturbed surface; toxic spills could not be buffered or absorbed by the shallow soils; increased acid drainage from bed rock exposed by excavation; on-site disposal of waste water could contaminate ground and surface water.

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Visual Resources	No effect from O&G activity.	No effect from O&G activity.*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Any O&G development/productic n activities would be highly visible and detract from the natural setting.
Recreational Use and Opportunities	No effect from O&G activity.	No effect from O&G activity.*	Mitigation may lessen potential impacts of oil and gas activity.	Would not be effective mitigation because of very short season of use for both activities (O&G and recreation).	O&G activity would generally result in a lessened recreational experience. Generally it conflicts with recreational use and opportunities.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Water Quality - Minimize area of surface disturbance; Containment and disposal of both surface and ground water.

Soils & Vegetation - Use of erosion control fabric, matts, geoweb soil support materials, lifting and saving tundra vegetation in chunks of sod to be later placed over disturbed areas, collection of local seeds for revegetation, use of chemical stabilizers, tackifiers and blankets and careful design of water flow over surface.

Recreational Use and Opportunities - Road and well pad location, noise mitigation.

TIMING LIMITATION IN THIS AFFECTED ENVIRONMENT :

Soils - Limit use to winter or dry summer conditions.

OTHER FACTORS TO CONSIDER:

Alpine areas within the analysis area are: Mt. Axtell, Carbon Peak, Whetstone Mountain, Lone Cone, Little Cone and Groundhog Mountain. Oil and gas activities in these areas is unlikely due to the geology of the area (igneous rocks).

AFFECTED ENVIRONMENT : High Geologic Hazard
ACRES : 52,000
MAPS : Figure III-6

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Geology	No additional impacts over natural undisturbed condition.	No additional impacts over natural undisturbed condition.	N/A (by regulations)	N/A (by regulations)	N/A (by regulations). Although regulations don't allow the operator to occupy the surface, there is potential for effects if the operator is not made aware of the hazard.
Water Quality	No effect from O&G activity.	No effect from O&G activity.*	N/A	N/A	N/A

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

The mitigation measures or design measures proposed by an operator in order to have the SUPO or waiver, modification, or exception approved would be site specific and not addressable at this level of analysis.

OTHER FACTORS TO CONSIDER:

The regulations (36 CFR 228.108(j)) do not allow the operator to occupy the surface in areas subject to mass soil movement, unless approved in the SUPO (part of the APD process). If stipulated or a Lease Notice is attached to the lease, the operator and the administrator are aware of the geologic hazard that exists in the lease parcel.

AFFECTED ENVIRONMENT : Moderate Geologic Hazard
ACRES : 629,000
MAPS : Figure III-7

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Geology	No additional impacts over natural conditions.	No additional impacts over natural conditions.	Potential for activation of landslides, earthflows and mudflows is lessened.	Timing would not provide mitigation over Standard Lease Terms.	Potential for activation of landslides, earthflows and mudflows.
Water Quality	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts of Standard Lease Terms with special measures (see below).	Timing Limitations would not significantly lessen impacts of Standard Lease Terms.	Increase in sedimentation into nearby drainages would decrease water quality. Potential for ground water contamination if mass movement occurs during drilling or production.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Special road design and well pad site design measures would be necessary. Design should be by qualified geotechnical engineers or engineering geologists. Design must consider drainage, backslope and fillslope ratios, and road grade and standards.

OTHER FACTORS TO CONSIDER:

Activities in areas of moderate geologic hazard (potentially unstable slopes; stabilized landslides, earthflows and mudflows; and avalanche chutes, etc.) can usually take place without causing unacceptable adverse impacts if the road or well pad site design recognizes the hazard and the design is appropriate for the hazard.

AFFECTED ENVIRONMENT : Roadless Areas
ACRES : 345,030
MAPS : Figures III-8a and III-8b

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Recreation/ Visual Resources/ Wilderness Values	No effect from O&G activity.	No effect from O&G activity.*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Construction of roads, well pads, pipelines, etc. would eliminate the roadless character.
Suited Timber Lands	No effect from O&G activity.	No effect from O&G activity.*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Potential for conflicts between O&G operators and timber purchasers if activities coincide.
Timber Lands Made Suitable	No effect from O&G activity.	No effect from O&G activity. Availability of road network on adjacent areas may allow future vegetative management (timber sales).*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Roads constructed for O&G activities may make areas economically viable for timber harvest; could slightly increase ASQ**; would allow management for wildlife habitat; allow control of insects, disease and wildfires.
Wildlife	No effect from O&G activity.	No effect from O&G activity.*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Increased human activity into previously inaccessible area would disturb animals causing some to relocate to less secure/desirable habitats, increasing stress and mortality. Increased trapping pressure on furbearers could eliminate local populations of certain species.

* No effect unless stipulation is waived, excepted or modified.
** Would require additional NEPA analysis and Forest Plan amendment before any harvest could occur.

OTHER FACTORS TO CONSIDER:

What is occurring on adjacent Forests and BLM land?

Roadless character would change if any ground disturbing activities occur within the roadless area. Some roadless areas are more sensitive than others (Tabeguache, Roubideau & Kannah Creek have been mentioned in legislation). Numerous roadless areas have existing leases.

AFFECTED ENVIRONMENT : Research Natural Areas
ACRES : 655
MAPS : Figure III-9

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Proposed Tabeguache Natural Area	No effect from O&G activity.	No effect from O&G activity.*	Ground disturbance within a RNA would conflict with the intended use.		

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Activity allowed must be in concert with the intended use of an RNA (see below).

OTHER FACTORS TO CONSIDER:

The intended use of a RNA is for research, study, observations, monitoring and educational activities that are non-destructive and non-manipulative, and that maintain unmodified conditions. RNA's are to be withdrawn from mineral entry and leasing at the time of establishment (FSM 4063.49, R2 Supplement #1).

Generally, physical improvements, such as roads are not permitted (Forest Plan).

AFFECTED ENVIRONMENT : Sensitive Areas
ACRES : 29,000
MAPS : Figure III-10

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Recreation Opportunities	No effect from O&G activity.	No effect from O&G activity.*	The casual forest visitor would only be aware of the O&G activity by seeing the associated traffic. The on-the-ground developments would not be readily visible.	Limiting drill pad development to periods of low recreation use would minimize conflict between industrial development and public.	Potential for conflicts on roads between public, O&G operators and timber purchasers if activities coincide. Visible development may alter the recreation use.
Visual Resources	No effect from O&G activity.	No effect from O&G activity.*	Impacts from Standard Lease Terms would be lessened through special mitigation (see below).	Same impacts as Standard Lease Terms.	Visual quality would be reduced by presence of O&G development/ production facilities (drill pads, roads, storage tanks, pumpjacks).

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Visual Resources - Only allow drill pad development and use when vegetation or land form screening would minimize visual impacts. Structures should be colored to blend with natural landscape.

TIMING LIMITATION IN THIS AFFECTED ENVIRONMENT:

Recreation Opportunities - Limit development to periods of low recreation use.

OTHER FACTORS TO CONSIDER:

Recent Forest Plan Amendment specifically designates these as not suited for timber harvest because of their value in relatively undisturbed condition.

AFFECTED ENVIRONMENT : Retention VQO
ACRES : 7800
MAPS : Figure III-11

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Visual Resources	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts of Standard Lease Terms through special mitigation (see below).	Same as Standard Lease Terms.	Presence of drill pads, access roads, commercial vehicles, storage tanks, pumpjacks would not meet the adopted visual quality objective.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Drill pads would only be sited within areas where they would not alter the Retention VQO, and motorized travel would be limited to the existing open road system. Oil and gas activity would not be evident to the causal forest user.

AFFECTED ENVIRONMENT : Retention VQO and Low VAC
ACRES : 7210
MAPS : Figure III-12

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Vegetation	No effect from O&G activity.	No effect from O&G activity.*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Vegetation removal would result in loss of screening in an area where the existing screen is important.
Visual Resources	No effect from O&G activity.	No effect from O&G activity.*	Some mitigation of effects as vegetative and soil disturbance would be minimized.	Same as Standard Lease Terms.	Construction of O&G development facilities would be incompatible with the desired VQO, due to the low VAC.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Visual Resources - Limit activities to areas of existing disturbance.

AFFECTED ENVIRONMENT : Scenic Byway Corridors
ACRES : 18,140
MAPS : Figure III-13

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Scenic Byway Corridors	No effect from O&G activity.	No effect from O&G activity.*	Exclusion of drill pad development and operation in foreground seen along heavily used recreation corridors is only mitigation to O&G activities.	Timing Limitations could lessen impacts by: -limit drill pad development to low rec. use periods.	O&G development and production activities along heavily used recreation corridors would degrade the visual quality and use would decrease. Use conflicts between public and O&G operators on road potentially would occur.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Exclude drill pad development and operation in the foreground seen along scenic byways. Require all structures (drill rigs, tanks, buildings) in middle ground to be colored to blend with the natural landscape.

AFFECTED ENVIRONMENT : Semi-Primitive Non-Motorized (3A Mgnt Area)
ACRES : 13,700
MAPS : Figure III-14

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Recreation Opportunities	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts of Standard Lease Terms through special mitigation (see below); however some reduction in quality of recreation experience would occur.	Same as Standard Lease Terms.	Construction of development/ production facilities would change the SPNM ROS class to a more developed ROS class. Potential for conflicts on roads between public, O&G operators and timber purchasers if activities coincide.
Visual Resources	No effect from O&G activity.	No effect from O&G activity.*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Inventoried VQO would be changed in retention and partial retention areas.
Timber Lands made Suitable	No effect from O&G activity.	No effect from O&G activity. Availability of road networks on adjacent areas may allow future vegetative management (timber sales).	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Roads constructed for O&G activities may make areas economically viable for timber harvest; ASQ** could be slightly increased; management could occur for wildlife habitat, insect, disease and wildfire control.

* No effect unless stipulation is waived, excepted or modified.
** Would require additional NEPA analysis and Forest Plan amendment before any harvest could occur.

CSU IN THIS AFFECTED ENVIRONMENT :

Recreation Opportunities - Oil and gas access roads would be closed to general public use.

OTHER FACTORS TO CONSIDER:

Forest Plan says mineral exploration and development is compatible if roads are closed to public use.

AFFECTED ENVIRONMENT : Administrative Sites
ACRES : 35
MAPS : No

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Admin. Sites	No effect from O&G activity.	No effect from O&G activity.*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	O&G activities would interfere with use of administrative sites (traffic, noise, etc.).

* No effect unless stipulation is waived, excepted or modified.

OTHER FACTORS TO CONSIDER:

Road or pipeline locations.

Standard Lease Terms provide for reasonable mitigation - it would be reasonable to move an operator away from an administrative site.

Administrative sites are generally about 5 acres. A well pad is typically 3 acres.

AFFECTED ENVIRONMENT : Recreation Complexes
ACRES : 62,975
MAPS : Figures III-15, III-16 and III-17

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Developed Recreation	No effect from O&G activity.	No O&G activities would be allowed within developed recreation sites. Special mitigation (listed below) would be applied to lessen impacts.*	Lessen Standard Lease impacts through special mitigation (see below). Timing stipulations would also be applied. No O&G activities would be allowed within developed recreation sites. Special mitigation (listed below) would be applied to lessen impacts.	Timing Limitations could lessen impacts by: -limit drill pad development to low rec. use periods.	Developed site recreation experience/quality would be significantly impacted by O&G development and production activities and use would decrease.
Dispersed Recreation	No effect from O&G activity.	No effect from O&G activity.*	Lessen Standard Lease impacts through special mitigation (see below).	Timing limitations would not be effective. Character of area would still be altered.	Construction of roads and drill pads would alter the semi-primitive nature of the area.
Major Trail Systems	No effect from O&G activity.	No effect from O&G activity.*	Lessen Standard Lease impacts through special mitigation (see below).	Timing limitations would lessen impacts - limit drilling activity to low rec. use periods. Ex: Limit drilling to winter for Crag Crest NRT. Limit drilling to summer for cross country ski trails.	Trail experiences/recreation quality would be impacted by O&G development activities (noise of drilling, views of drill/well sites).

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Developed Recreation - Drilling locations must be at least 1 mile from developed sites. Operation may be allowed only during certain times of the day. Noise abatement measures may be required. Special requirements to retain visual quality may be required. Odor reduction measures may be required.

Dispersed Recreation - Locate O&G development outside of dispersed recreation complexes. Limit use of motorized vehicles to existing roads in their current condition.

Major Trail Systems - Drill pad and road location at least 1/4 mi. from cross country ski trails and 1 mi. from Crag Crest NRT. All structures visible from a distance would be colored to blend with natural landscape.

TIMING LIMITATIONS IN THIS AFFECTED ENVIRONMENT:

Developed Recreation - Limit drill pad development to low recreation use periods.

Major Trail Systems - Limit drill activities to winter along Crag Crest National Recreation Trail. Limit drilling activities to summer along cross country ski trails.

OTHER FACTORS TO CONSIDER:

Activities on adjacent areas.

AFFECTED ENVIRONMENT : Watersheds of Special Interest to Municipalities
ACRES : 117,000
MAPS : Figure III-18

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Vegetation	No effect from O&G activity.	No effect from O&G activity.*	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Vegetation removal for construction of roads and well pad sites may result in adverse impacts to soil & water resources.
Water Quality and Quantity	No effect from O&G activity.	Directional drilling has potential to contaminate groundwater if water from different aquifers is allowed to mix or if drilling fluids escape into aquifers.	Impacts associated with Standard Lease terms would be lessened through special mitigation measures (see below).	Restricting use during spring & fall would reduce the potential for sediment production. Other impacts would be similar to Standard Lease terms.	Increased sediment resulting from roads, well pads, pipelines. Risk of contamination from spills on-site and in transport. Acquisition of water for drilling could reduce quantity available downstream. Drilling could contaminate groundwater if aquifers are allowed to mix, or if drilling fluids or produced waters escape into aquifers.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Water Quality and Quantity: Fuel storage and spill plans required; all reserve mud pits would be closed systems; all road drainage work would be kept current; surfacing required for all roads planned for all weather use; all waste, refuse and trash would be kept in closed containers and regularly removed from watershed; no surface water diversions; no surface use within 1/4 mile of surface water intakes or spring developments. (This includes new and existing roads.).

OTHER FACTORS TO CONSIDER:

Fourteen (14) municipal watersheds are identified within the analysis area. Presently none are given special protection under the Forest Plan.

AFFECTED ENVIRONMENT : Slopes 40-60%
ACRES : 33,530
MAPS : Figure III-19

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Vegetation	No effect from O&G activity.	No effect from O&G activity.*	Mitigation listed below may help the rehabilitation effort.	Timing limitations would not mitigate effects.	Diversity of veg. species lost from disturbed areas (revegetation usually uses just a few species) - tree vegetation would be lost for years, replaced by early succession species. Revegetation efforts are much more difficult on steep slopes.
Visual Resources	No effect from O&G activity.	No effect from O&G activity.*	Mitigation listed below may help the rehabilitation effort.	Timing limitations would not mitigate effects.	Steep slopes expose any activity to view, making their visual impact much greater. Long cut and fill banks are required, creating "scars" which can be seen from long distances. The steeper the slope the more significant the effect.
Soils	No effect from O&G activity.	No effect from O&G activity.*	Would reduce continuous impact reported under Standard Lease Terms but still presents significant opportunity for accidents or for single event soil loss episodes, and potential for mass failure.	Timing Limitations would lessen the potential for effects during construction.	See Appendix F for amount of area disturbed to construct roads or drill sites under various slope conditions. Activities on steep slopes would result in increased potential for erosion, soil loss and sedimentation. Cut bank and fill would reach into parent materials, offering no developed soil properties. Revegetation would be difficult. Steep slopes exposed and oversteepened during construction would be subject to mass soil movement and loss in single event summer thunder storms.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Vegetation and Soils - Use of erosion control cloths, mats, geoweb soil support materials, lifting and saving local native vegetation in chunks of sod to be later placed over disturbed areas, reseeding disturbed banks with stabilizing seed mix, use of chemical stabilizers, tackifiers and blankets and careful design of water flow over surface.

Visual Resources - Road and well pad location would be placed so Visual Quality Objectives would be retained.

AFFECTED ENVIRONMENT : Slopes >60%
ACRES : 3415
MAPS : Figure III-20

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Vegetation	No effect from O&G activity.	No effect from O&G activity.*	Mitigation listed below may help the rehabilitation effort.	Timing limitations would not mitigate effects.	Diversity of veg. species lost from disturbed areas (revegetation usually uses just a few species) - tree vegetation would be lost for years, replaced by early succession species. Revegetation efforts are much more difficult on steep slopes.
Visual Resources	No effect from O&G activity.	No effect from O&G activity.*	Mitigation listed below may help the rehabilitation effort and reduce the term of the visula impact.	Timing limitations would not mitigate effects. Same as Standard Lease Terms.	Steep slopes expose any activity to view, making their visual impact much greater. Long cut and fill banks are required , creating "scars" which can be seen from long distances. The effects are greatly magnified on steeper than 60% slopes.
Soils	No effect from O&G activity.	No effect from O&G activity.*	Would reduce continuous impact reported under Standard Lease Terms but still presents significant opportunity for accidents or for single event soil loss episodes, and potential for mass failure.	Timing limitations would lessen the potential for effects during construction.	See Appendix F for amount of area disturbed to construct roads or drill sites under various slope conditions. Activities on steep slopes would result in increased erosion hazard, soil loss and sedimentation. Cut bank and fill would reach far into parent materials, offering no developed soil properties. Revegetation would be difficult. Steep slopes exposed and oversteepened during construction would be subject to mass soil movement and loss in single event summer thunder storms.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Soils - Use of erosion control fabric, matts, geoweb soil support materials, lifting and saving local native vegetation in chunks of sod to be later placed over disturbed areas, reseeding disturbed banks with stabilizing seed mix, use of chemical stabilizers, tackifiers and blankets and careful design of water flow over surface.

Visual Resources - Siting of facilities would take advantage of natural screening.

OTHER FACTORS TO CONSIDER:

In some locations soils would facilitate engineered cut slopes steeper than a 1:1 or 1 1/2 : 1.

The regulations at 36 CFR 228.108(j)(2) state: *The operator shall take measures to minimize or prevent erosion and sediment production. Such measures include, but are not limited to, siting structures, facilities, and other improvements to avoid steep slopes and excessive clearing of land.*

AFFECTED ENVIRONMENT : Big Game Winter Range
ACRES : 207,450
MAPS : Figure III-21

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Populations & Use	No effect from O&G activity.	No effect from O&G activity.*	Impacts would be lessened by measures listed below.	Lessen impacts with measure listed below. Human activity along roads during winter would result in displacement of animals, increased stress and mortality.	If O&G activities occurred on winter range during the critical use period (winter), animals would be displaced to less desirable areas or other occupied winter ranges, resulting in increased stress and mortality. Human activity along remaining roads during winter would have the same effect. There would be little direct effect to animals if disturbance occurred during summer.
Habitat Condition	No effect from O&G activity.	No effect from O&G activity.*	Potential decrease in carrying capacity from vegetation removal.	Potential decrease in carrying capacity from vegetation removal.	Potential decrease in carrying capacity from vegetation removal.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Limit road use to periods when animals are not present on the winter range. Restrict road use to operators. Recountour and revegetate to prior existing conditions (to the extent possible) new roads when work is completed.

TIMING LIMITATIONS IN THIS AFFECTED ENVIRONMENT :

Restrict O&G activities during winter when animals are on these areas. (12/1 - 4/30)

OTHER FACTORS TO CONSIDER:

Activities on adjacent land.

AFFECTED ENVIRONMENT : Elk Calving Areas
ACRES : 45,230
MAPS : Figure III-22

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Populations & Use	No effect from O&G activity.	No effect from O&G activity.*	Impacts would be lessened.	Timing limitations would mitigate the adverse effects associated with human activity in the area during calving.	If O&G activities occurred in birthing areas during critical periods animals would be displaced to less desirable areas or areas already occupied, resulting in increased stress and mortality. Human activity along roads constructed for O&G activities would have the same effect. There would be little direct effect to animals if use occurred at other times.
Habitat Condition	No effect from O&G activity.	No effect from O&G activity.*	Potential loss of security cover resulting from direct habitat manipulation and human activity.	Potential loss of security cover resulting from direct habitat manipulation and human activity. Potential decrease in carrying capacity if animals are displaced from adjacent areas. Loss of security cover resulting from direct habitat manipulation and human activity.	Potential decrease in carrying capacity if animals are displaced from adjacent areas. Loss of security cover resulting from direct habitat manipulation and human activity.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Limit road use to periods when animals are not present. Restrict road use to operators. Restrict road construction in critical birthing areas. Recontour and revegetate to prior existing conditions (to the extent possible) new roads when work is complete.

TIMING LIMITATIONS IN THIS AFFECTED ENVIRONMENT :

Restrict O&G activities during calving periods (4/16-6/30 calving).

OTHER FACTORS TO CONSIDER:

Potential timber sale activity following roading for oil and gas activities would impact wildlife habitats through loss of habitat and increased human activity resulting in disturbance, habitat abandonment, increased stress and mortality.

AFFECTED ENVIRONMENT : Big Game Migration Routes & Staging Areas
ACRES : Not applicable
MAPS : No

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Migration Routes & Staging Areas	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts by moving oil and gas activity away from important habitat.	Lessen impacts by protecting habitat during critical use period.	Potential disturbance during critical periods leading to displacement, avoidance, increased stress and mortality.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Physically protect habitat by controlling any new road construction/pad construction or other development in travel corridor. Recontour and revegetate to prior existing conditions (to the extent possible) new roads when work is complete.

TIMING LIMITATIONS IN THIS AFFECTED ENVIRONMENT :

Prevent activities from occuring during use periods (3/1-5/30 and 11/1-12/31).

OTHER FACTORS TO CONSIDER:

Potential timber sale activity following roading for oil and gas would impact wildlife habitats through loss of habitat, increased human activity resulting in disturbance, habitat abandonment, increased stress and mortality.

AFFECTED ENVIRONMENT : Bighorn Sheep Lambing/Breeding Areas
ACRES : 9335 (entire range)
MAPS : Figure III-23

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Bighorn Sheep Lambing/ Breeding Areas	No effect from O&G activity.	No effect from O&G activity.*	Some mitigation of impacts by moving oil and gas activity away from important habitat area. Potential for loss of important habitat through vegetation manipulation.	Protect habitat during critical use periods. Potential for loss of important habitat through vegetation manipulation.	Potential disturbance during critical periods could result in avoidance, increased stress and mortality. Potential for loss of important habitat through vegetation manipulation.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Limit road use to periods when animals are not present. Restrict road use to operators. Recontour and revegetate to prior existing conditions (to the extent possible) new roads when work is complete.

TIMING LIMITATIONS IN THIS AFFECTED ENVIRONMENT :

Restrict O&G activities during lambing (5/1-7/15) and breeding (11/1-1/1) periods.

OTHER FACTORS TO CONSIDER:

Potential timber sale activity following roading for oil and gas would impact wildlife habitats through loss of habitat, increased human activity resulting in disturbance, habitat abandonment, increased stress and mortality.

AFFECTED ENVIRONMENT : Summer Range (Concentrated Use)
ACRES : 81,440
MAPS : Figure III-24

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Big Game Summer Range	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts by moving oil and gas activity away from important habitat area.	Protect habitat during critical use periods.	Potential disturbance during critical periods could result in avoidance, increased stress and mortality. Potential for early displacement onto private property.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Limit road use to periods when animals are not present. Restrict road use to operators. Recontour and revegetate to prior existing conditions (to the extent possible) new roads when work is complete.

TIMING LIMITATIONS IN THIS AFFECTED ENVIRONMENT :

Restrict oil and gas activities during periods of heavy use.

OTHER FACTORS TO CONSIDER:

Potential timber sale activity following roading for oil and gas would impact wildlife habitats through loss of habitat, increased human activity resulting in disturbance, habitat abandonment, increased stress and mortality.

AFFECTED ENVIRONMENT : Sage Grouse Leks
ACRES : 160
MAPS : No

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Sage Grouse Leks	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts by not allowing construction within buffer around lek areas.	Limit oil and gas activities during lek use (3/1 - 5/31).	Potential for loss of habitat, increased human disturbance resulting in area avoidance, reduction of breeding and decrease in reproduction.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Restrict oil and gas activities within 2.5 miles. Site specific buffers would be established at Application for Permit to Drill stage.

TIMING LIMITATIONS IN THIS AFFECTED ENVIRONMENT :

Restrict oil and gas activities within buffer during breeding and nesting periods (3/1 - 5/31).

OTHER FACTORS TO CONSIDER:

Activities on adjacent lands.

AFFECTED ENVIRONMENT : Utility Corridors/Electronic Sites
ACRES : 4535
MAPS : No

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Utility Corridors	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts of Standard Lease through special stipulation (see below).	Same as Standard Lease Terms.	Potential for conflict between drill towers and power transmission lines.
Electronic Sites	No effect from O&G activity.	No effect from O&G activity.*	Lessen impacts of Standard Lease through special stipulation (see below).	Same as Standard Lease Terms.	Drilling/production activities would generate electromagnetic disturbances which would conflict with electronic transmissions.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Utility Corridors - Exclude drill pad development in corridors.

Electronic Sites - Exclude drilling/production activities where electromagnetic disturbances would affect electronic transmissions.

AFFECTED ENVIRONMENT : Primary Rangeland (6B Management Area)
ACRES : 395,000
MAPS : Figure III-25

ENVIRONMENTAL CONSEQUENCES

ENVIRON MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Vegetation	No effect from O&G activity.	No effect from O&G activity.*	Mitigation of most of the effects related to new ground disturbance (see below).	Vegetative disturbances would still occur (loss of forage, range carrying capacity, sensitive plant associations and introduction of noxious weeds or less desirable plants).	Loss of forage, range carrying capacity, sensitive plant associations, and noxious weeds or less desirable plants may be introduced. Indirect impacts resulting from timber managment resulting in areas previously unroaded.
Livestock Grazing	No effect from O&G activity.	No effect from O&G activity.*	People and equipment related disturbances would still occur on existing travelways.	Disturbance would be limited to vegetation and soils. People and equipment related disturbances to livestock would be mitigated.	May conflict to small degree with wildlife needs due to increased competition (less forage available, displaced wildlife). Gates could be left open allowing undesirable livestock movement. Poaching of livestock, vandalism, conflict with recreationists. May provide better access for permitees, moving livestock on/off, and other management.

* No effect unless stipulation is waived, excepted or modified.

CSU IN THIS AFFECTED ENVIRONMENT :

Limit activities to existing road and/or utility corridors.

TIMING LIMITATIONS IN THIS AFFECTED ENVIRONMENT :

No drilling would occur during 6/1-10/15.

OTHER FACTORS TO CONSIDER:

Activities on adjacent lands.

AFFECTED ENVIRONMENT : Lands Suited for Timber Harvest
ACRES : 287,000
MAPS : Figures III-26a and III-26b

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	LEASE OPTIONS				
	NO LEASE	NSO	CSU	TIMING	STD. LEASE
Timber Lands Made Suitable	No effect from O&G activity.	No effect from O&G activity.* Availability of road network on adjacent areas may allow future vegetative management (timber sales).	Same as Standard Lease Terms.	Same as Standard Lease Terms.	Roads constructed for O&G activities may make areas economically viable for timber harvest; could slightly increase ASQ**; would allow management for wildlife habitat, control of insects, disease and wildfires.

* No effect unless stipulation is waived, excepted or modified.
** Would require additional NEPA analysis and Forest Plan amendment before any harvest could occur.

OTHER FACTORS TO CONSIDER:

Concurrent O&G and timber activities.

Summary Comparison of Program Alternatives

AFFECTED ENVIRONMENT : General Forest

ENVIRONMENTAL CONSEQUENCES

ENVIRON-MENTAL FACTORS	ALTERNATIVES				
	1 - NO ACTION	2 - PREFERRED	3 - NO LEASE	4 - STANDARD LEASE TERMS	5 - NO LEASE ROADLESS AND SPNM
Biological Diversity	Same as Alternative 4.	No increased impacts to biological diversity on NSO designated areas.* Temporary loss of biological diversity may result on sites cleared for roads, well pads and pipelines. Some loss of biological diversity of wildlife species, especially in areas opened for logging following O&G activities.	Effects only on existing leases.	Temporary loss in biological diversity resulting from roads, well pad and pipeline construction, Loss of biological diversity of wildlife species, especially in areas opened for logging following O&G activity.	No increased impacts to biological diversity in Roadless and SPNM areas. Impacts on remaining areas same as Alternative 2.
Vegetation	Same as Alternative 4.	Same as Alternative 4.	Effects only on existing leases.	Vegetation removal for pads, roads, pipelines would remove sites from wood fiber and/or forage production. Abandoned drill sites and road locations may be restored to full vegetation over long-term. May result in slightly increased ASQ.**	Same as Alternative 4.
Soils	Same as Alternative 4.	NSO recommended for sensitive soils in riparian and alpine/tundra environments would prevent irretrievable/ irreversible impacts in these areas. Potential for displacement, compaction and mixing on construction locations in remainder of analysis area.	Effects only on existing leases.	Construction activities result in displacement, compaction and mixing of soil material. Increased potential for erosion and slope failures. Impacts vary with slope and soil type. Forest Plan guidelines provide mitigation through road design and revegetation requirements.	No effect from O&G activity in Roadless and SPNM areas. Same impacts as Alternative 2 in remainder of analysis area.
Air Quality	Minimal impact to air quality. Some dust from road use.	Minimal impact to air quality. Some dust from road use.	Effects only on existing leases.	Minimal impact to air quality. Some dust from road use.	Minimal impact to air quality. Some dust from road use.

ENVIRON-MENTAL FACTORS	ALTERNATIVES				
	1 - NO ACTION	2 - PREFERRED	3 - NO LEASE	4 - STANDARD LEASE TERMS	5 - NO LEASE ROADLESS AND SPNM
Water Quality	Some increase in sediment. Overall impact low. Some risk of spills at drill sites and stream crossings.	Some increase in sediment, but most sensitive areas protected. Accidental spills could occur. Overall impact low.	Effects only on existing leases.	Some increase in sediment. No special protection of sensitive areas. Overall impact moderate. Risk of spill similar to other alternatives.	Some increase in sediment. Impacts confined to areas of existing development. Overall, impacts very low.
Range and Livestock Grazing	Same as Alternative 4.	Same as Alternative 4.	Effects only on existing leases.	Surface disturbance would remove forage. Increased access and activity may result in temporary reduction of permitted livestock or change in management system in areas of activity. Potential for introduction of noxious and undesirable plants along roads, well pads and pipelines. Increased access could aid in range management activities.	No effect from O&G activity in Roadless and SPNM areas. Impacts same as Alternative 4 for remainder of analysis area.
Roads	Same as Alternative 4.	No impacts in No Lease and NSO stipulated areas. Impacts same as Alternative 4 in remainder of analysis area.	Effects only on existing leases.	Potential for new road construction in entire analysis area. Road reconstruction would generally increase standard of existing road. Road use would increase during exploration and development stages.	No impacts in Roadless, SPNM and other No Lease and NSO areas identified in Alternative 2. Impacts same as Alternative 4 on remainder of analysis area.
Visual Resources	Alternative 4 impacts lessened through use of vegetative and topographic screening, facility placement, design and color to meet VQO in Retention and Low VAC areas.	Impacts lessened from No Action by retaining VQO in Scenic Byway Corridors in addition to Retention VQO and Low VAC areas.	Effects only on existing leases.	Potential impacts to visual resources greatest during exploratory drilling, less during development and production. Negative impacts to Retention VQO with and without Low VAC (19% of analysis area).	No effect from O&G activity in Roadless and SPNM areas. Impacts same as Alternative 2 in remainder of analysis area.

ENVIRON-MENTAL FACTORS	ALTERNATIVES				
	1 - NO ACTION	2 - PREFERRED	3 - NO LEASE	4 - STANDARD LEASE TERMS	5 - NO LEASE ROADLESS AND SPNM
Recreation Opportunities	Recreation opportunities in developed facilities and SPNM areas would be protected. Potential for ROS class to be changed to more developed class in dispersed recreation and Roadless areas. Potential decrease in backcountry recreation opportunities.	Recreation opportunities would be protected in identified developed, dispersed and major trail recreation complexes and in several Roadless Areas. Potential for ROS class to be changed to more developed class in dispersed recreation and Roadless areas. Potential decrease in backcountry recreation opportunities.	Effects only on existing leases.	Improved road standards and increased traffic will alter ROS class to more developed conditions and potentially decrease recreation experience of Forest visitors. Opportunity for backcountry recreation will be reduced.	No effect from O&G activities in Roadless, SPNM and recreation complexes. Impacts same as Alternative 2 in remainder of analysis area.
Cultural and Historical Resources	Same as Alternative 4.	Same as Alternative 4.	Effects only on existing leases.	Cultural survey is required prior to any ground disturbing activity. Any identified cultural resources must be protected by avoidance, or recorded and excavated.	No effect from O&G activity in Roadless and SPNM areas. Impacts in remainder of analysis area same as Alternative 4.
Aquatic/ Riparian/ Wetland Habitats	Same as Alternative 4.	Same as Alternative 4.	Effects only on existing leases.	Potential impacts from road construction, culvert location and stream crossings resulting in vegetation removal and increased sediment loads, which would decrease spawning habitat, result in macroinvertebrate and fish fry mortality. Increased potential for toxic spills entering waterways.	No effect from O&G activity within Roadless and SPNM areas. Impacts in remainder of analysis area same as Alternative 4.

ENVIRON-MENTAL FACTORS	ALTERNATIVES				
	1 - NO ACTION	2 - PREFERRED	3 - NO LEASE	4 - STANDARD LEASE TERMS	5 - NO LEASE ROADLESS AND SPNM
Wildlife	Same as Alternative 4.	Impacts to wildlife and habitat mitigated through NSO, CSU and TL in special habitats. Potential for habitat loss, disturbance and displacement to less desirable habitats on areas with SLT. Impacts compounded in areas opened for logging after O&G activity.	Effects only on existing leases.	Forest Plan provides limited protection: -Timing restrictions for bighorn sheep lambing areas; -Timing restriction for raptor nesting; -Road use restrictions to maintain habitat effectiveness in MIS habitat (4B); -Road construction/use restrictions in big game winter range (5A &5B). Remainder of area open to Standard Lease Terms, which would result in habitat loss, disturbance, displacement to less desirable habitats, potential increase in conflicts on private land. Impacts compounded in areas opened for logging after O&G activity.	No direct impacts to wildlife in Roadless and SPNM areas. Impacts same as Alternative 2 on remainder of analysis area.
Wildfire	Potential for human caused wildfire would be similar for all alternatives, except for Alternative 3, which would have a slightly smaller potential for wildfire, due to less oil and gas activities. Improved access and increased human activity has the potential to result in increasing human caused wildfires. Increased access could allow more efficient suppression of wildfires, however; both man-caused or naturally occurring.				
Economic and Social Setting	Average of 10 more jobs (above No Lease figure) for 3 months; additional $4,000 State revenue; additional $8,000 County revenue from drilling on new leases.	Average of 10 more jobs (above No Lease figure) for 3 months; additional $4,000 State revenue; additional $8,000 County revenue from drilling on new leases.	Average of 10 full time drilling jobs; $32,000 State revenue; $64,000 County revenue from drilling on existing leases, annually.	Average of 10 more jobs (above No Lease figure) for 3 months; additional $4,000 State revenue; additional $8,000 County revenue from drilling on new leases.	Average of 10 more jobs (above No Lease figure) for 3 months; additional $4,000 State revenue; additional $8,000 County revenue from drilling on new leases.
Reasonably Foreseeable Development Scenario	The projected activity would occur, but typically in areas least restrictive to industry.		The 7 projected wells outside existing leases and units would not be drilled.	No effect on the RFD.	The projected activity would shift to areas available for oil and gas leasing.
Oil and Gas Resources - Availability	All legally available lands within the analysis area would be available for leasing; however, stipulations modify the Standard Lease Terms in some Affected Environments. 951,450 ac. available.	Oil and gas resources would be available for leasing except in selected Roadless Areas and Research Natural Areas. Special stipulations modify Standard Lease Terms. 813,180 ac. available.	Oil and gas resources within the analysis area would not be available for leasing. Oil and gas resources on existing leases are not effected. 0 ac. available.	All legally available lands within the analysis area would be available for leasing. No special stipulations would be applied. 951,450 ac. available.	Oil and gas resources within Roadless Areas and areas of SPNM would not be available for leasing. Otherwise this alternative is similar to Alternative 2. 552,300 ac. available.

ENVIRON-MENTAL FACTORS	ALTERNATIVES				
	1 - NO ACTION	2 - PREFERRED	3 - NO LEASE	4 - STANDARD LEASE TERMS	5 - NO LEASE ROADLESS AND SPNM
Oil and Gas Resources - Effect on Industry	Costs for the recovery of oil and gas resources would be higher than that of Alternative 4, but lower than Alternatives 2 & 5.	Generally, the costs related to the recovery of oil and gas resources would be higher than that of Alternative 4.	No opportunity to recover oil and gas resources (except on existing leases).	Least cost alternative for the recovery of oil and gas resources. May result in more interest in leasing.	Same as Alternative 2, but fewer lands available for leasing.

* No effect unless stipulation is waived, excepted or modified.
** Would require additional NEPA analysis and Forest Plan amendment before any harvest could occur.

Major Issue Comparison by Alternative

Major Issue: Slope Stability and Geologic Hazards

The *Affected Environments* to consider in the assessment of the potential for slope stability and geologic hazard problems include: High geologic hazards, moderate geologic hazards, slopes 40-60%, and slopes > 60%.

Alternative 1, 2, and 5 would treat high geologic hazard areas, moderate geologic hazard areas, slopes 40-60% and slopes > 60%, similarly. Under each of these alternatives on high geologic hazard areas and slopes > 60%, a *No Surface Occupancy* stipulation would be applied to oil and gas leases. In moderate geologic hazard areas and slopes 40-60% a *Controlled Surface Use* stipulation would be applied. The potential for slope stability and geologic hazard problems with these alternatives would be minimized through avoidance of these areas and facility design (roads and well pads) would be appropriate for the potential hazard.

Alternative 3 would result in no increased potential (over baseline levels) for slope stability and geologic hazard problems as a result of oil and gas activities.

Alternative 4 would apply *Standard Lease Terms* to high geologic hazard areas, moderate geologic hazard areas, slopes 40-60% and slopes > 60%. These areas would be available for lease with no special stipulations attached to the lease to specifically protect them from potential adverse environmental impacts. This alternative has the greatest potential to produce adverse effects, such as the acceleration or triggering of slope failures, excessive soil movement (erosion), and the resultant risk to the aquatic ecosystem if sediment reaches streams. Although this alternative has the greatest potential for adverse effects (slope stability and geologic hazards), the potential is still considered low, given the Surface Use Plan of Operations approval process.

Major Issue: Roadless and Undeveloped Areas

The *Affected Environments* to consider in the assessment of potential effects to Roadless and undeveloped areas include: Roadless Areas, Research Natural Areas, and the Semi-primitive Non-motorized areas (3A Management Areas).

Alternatives 1 and 4 would have similar effects to Roadless and undeveloped areas. In both alternatives, all Roadless Areas (about 345,000 acres) are available for oil and gas leasing with no special stipulations. In Alternative 1 Research Natural Areas and the Semi-primitive Non-motorized areas (3A Management Areas) would have *Controlled Surface Use* stipulations attached to the lease. In Alternative 4, these areas would be leased with *Standard Lease Terms* only. Oil and gas activity, regardless of stipulation in these areas, would have similar effects - the loss or degradation of undeveloped character.

Under Alternative 2, the Kannah Creek, Tabeguache, Roubideau, Whetstone Mountain, Flat Top Mountain and parts of West Elk (Snowshoe Mesa, Kebler Pass), Raggeds (Kebler Pass) and Priest Mountain (Flat Tops et al) Roadless Areas and Research Natural Areas (about 125,000 acres) would not be available for oil and gas leasing. The Battlement Mesa Roadless Area and Semi-primitive Non-motorized areas (3A Management Areas) would be available for leasing, but with a *No Surface Occupancy* stipulation. Little or no loss of the undeveloped character would occur in these areas.

Alternative 3 and 5 would result in no additional effects from new leasing to Roadless and undeveloped areas. Under these alternatives, these areas would not be available for oil and gas leasing.

Major Issue: Wildlife and Wildlife Habitat

The *Affected Environments* to consider in the assessment of potential effects to wildlife and wildlife habitat include: Aquatic/Riparian/Wetland Habitats, Roadless Areas, Wildlife Special Habitats (big game winter range, elk calving areas, migration routes and staging areas, bighorn lambing and breeding areas, concentrated use summer range, and sage grouse leks), and Threatened and Endangered Species. Threatened and Endangered species are protected under the Endangered Species Act under all alternatives.

Alternative 1 would provide current Forest Plan protection for wildlife and wildlife habitat. This would include *Controlled Surface Use* in Aquatic/Riparian/Wetland Habitats and big game winter range. *Timing limitations* would be applied to big game winter range, as well as bighorn sheep lambing and breeding areas. All other wildlife *Affected Environments* would be available for oil and gas leasing with *Standard Lease Terms* (no special mitigation).

Alternative 2 would provide protection to wildlife and wildlife habitats through the application of special stipulations in wildlife *Affected Environments*. With this alternative, Aquatic/Riparian/Wetland Habitats, concentrated use summer range, sage grouse leks, and bighorn sheep lambing and breeding areas, the Battlement Mesa Roadless Area and Semi-primitive Non-motorized areas (3A Management Areas) would be protected with *No Surface Occupancy* stipulations. Additionally, the Kannah Creek, Tabeguache, Roubideau, Whetstone Mountain, Flat Top Mountain and parts of West Elk (Snowshoe Mesa, Kebler Pass), Raggeds (Kebler Pass) and Priest Mountain (Flat Tops, et al) Roadless Areas would not be available for oil and gas leasing. Wildlife in big game winter range, elk calving areas, and migration routes would be protected with *Controlled Surface Use* and *Timing Limitation* stipulations.

Under Alternative 3, none of the wildlife *Affected Environments* in the analysis area would be available for oil and gas leasing.

Under Alternative 4, all of the wildlife *Affected Environments* would be available for oil and gas leasing with *Standard Lease Terms,* only (no special mitigation). The potential for adverse effects to wildlife and wildlife habitats would be the greatest with this alternative.

Under Alternative 5, protection to wildlife and wildlife habitats would be similar to that in Alternative 2, but with additional protection to wildlife and wildlife habitats in Roadless Areas and Semi-primitive Non-motorized areas (3A Management Areas), which would not be available for oil and gas leasing under this alternative.

Major Issue: Recreational Activities and Experiences

The *Affected Environments* to consider in assessing potential impacts to recreational activities and experiences include: Sensitive Areas, Retention VQO - Low VAC, Retention VQO, Scenic Byway Corridors, Roadless Areas, Semi-primitive Non-motorized areas (3A Management Areas), and Recreation Complexes.

Alternative 1 provides protection for recreational activities and experiences with special stipulations in all of the recreation-related *Affected Environments* except for Roadless Areas. No special protection would be afforded Roadless Areas with this alternative. *Controlled Surface Use* stipulations would be applied to Sensitive Areas, Retention VQO areas, Scenic Byway Corridors, Semi-primitive Non-motorized areas (3A Management Areas), and Recreation Complexes. *Controlled Surface Use* in these *Affected Environments* would still likely result in some degradation of the recreational activity and experience. *No Surface Occupancy* would be applied to Retention VQO - Low VAC areas.

Alternative 2 would protect Sensitive Areas, Retention VQO - Low VAC, Semi-primitive Non-motorized areas (3A Management Areas), most Recreation Complexes (cross country ski trails

would have *Timing Limitations*) and the Battlement Mesa Roadless Area with *No Surface Occupancy* stipulations. Kannah Creek, Tabeguache, Roubideau, Whetstone Mountain, Flat Top Mountain and parts of West Elk (Snowshoe Mesa, Kebler Pass), Raggeds (Kebler Pass) and Priest Mountain (Flat Tops, et al) Roadless Areas would not be available for oil and gas leasing. Retention VQO and Scenic Byway Corridors would have *Controlled Surface Use* stipulations that protect the scenic values in those areas. Recreational activities and experiences would generally be maintained in these areas, under Alternative 2.

Recreational activities and experiences would not be affected with the selection of Alternative 3. Recreational opportunities would remain unchanged.

All recreation-related *Affected Environments* would be available for oil and gas leasing under Alternative 4 and potentially affected by oil and gas activity. *Standard Lease Terms* would do little to mitigate the potential for effects on recreational activities and experiences.

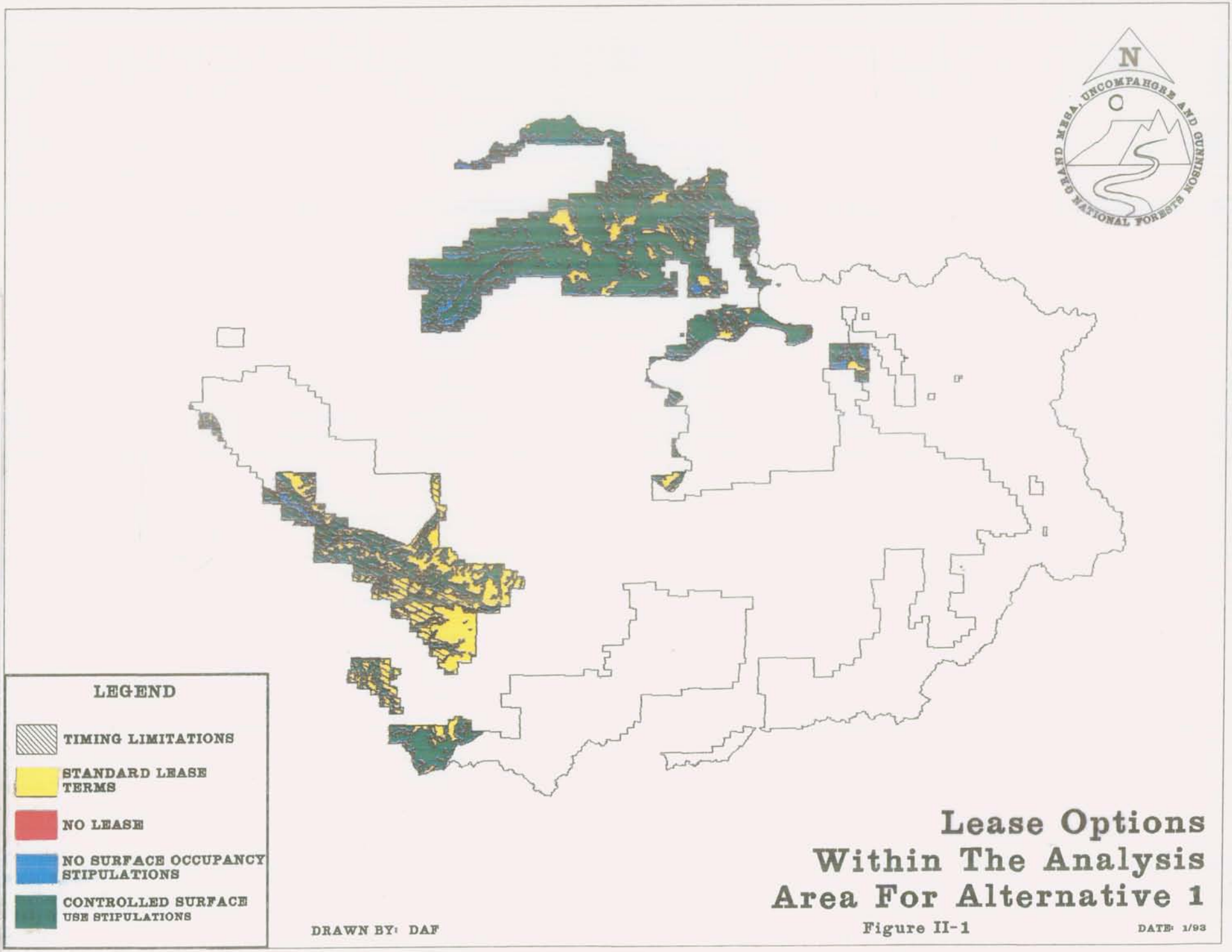
Alternative 5 would result in similar effects as Alternative 2; however, effects on Roadless and Semi-primitive Non-motorized recreation values would be maintained to a higher level, and on more land. Roadless Areas and Semi-primitive Non-motorized areas (3A Management Areas) would not be available for oil and gas leasing.

Major Issue: Cumulative Effects

The potential for cumulative effects to *Affected Environments* is directly related to the location, timing, and amount of activity projected. Alternatives 1, 2, 4, and 5 have the same amount of activity projected, 47 wells. Alternative 3, which emphasizes no new leases, would result in 40 wells drilled. The greatest potential for cumulative effects from oil and gas activities would occur in those areas where concentrated oil and gas activities are projected, such as those areas covered under exploratory unit agreements. If timber sale and other activity, such as concentrated recreational use and livestock grazing also occurs in those areas, the potential for cumulative effects to surface resources would be increased.

Generally, the amount and timing (an average of 3.3 wells/year) of projected oil and gas activity is such that, no significant cumulative effects would be likely to occur. The amount of ground disturbance, about 35 acres per year (10.7 acres/well - see Analysis Assumptions), and oil and gas activity related traffic (an average increase of 13 vehicles per day per well for an average of 60 days) would increase the potential for cumulative effects incrementally. The effects would likely be short-term and not of major significance.

Additional cumulative effects to consider are ongoing and proposed timber sales in the analysis area, plus the potential of additional sales occurring in areas made economically suitable as a result of roads constructed for oil and gas activities. Before any currently uneconomically suited areas can be included in the Forest's ASQ, additional environmental analysis and Forest Plan amendment must occur.



Lease Options Within The Analysis Area For Alternative 1

Figure II-1

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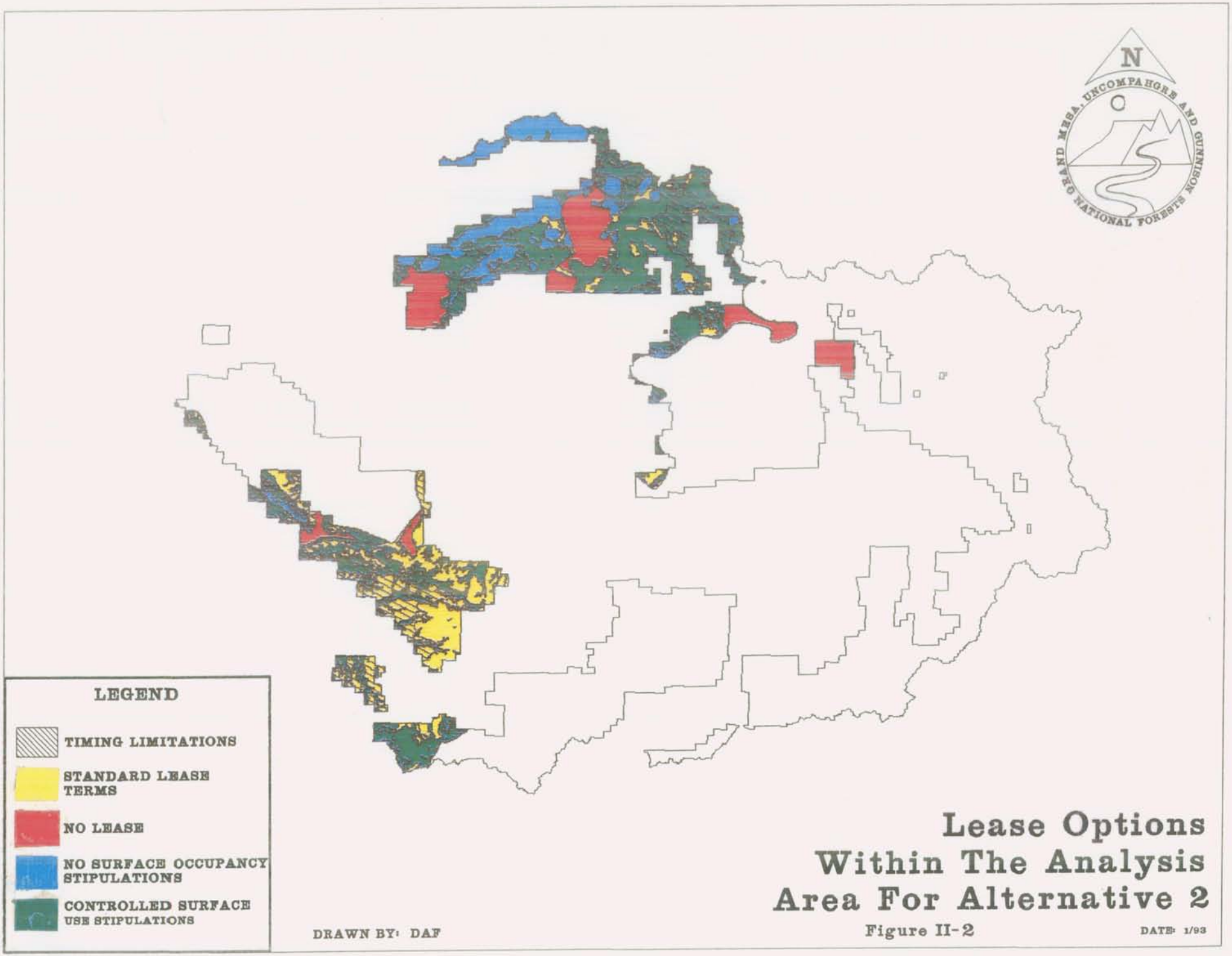
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LEGEND
TIMING LIMITATIONS
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NO LEASE
NO SURFACE OCCUPANCY STIPULATIONS
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Lease Options Within The Analysis Area For Alternative 2
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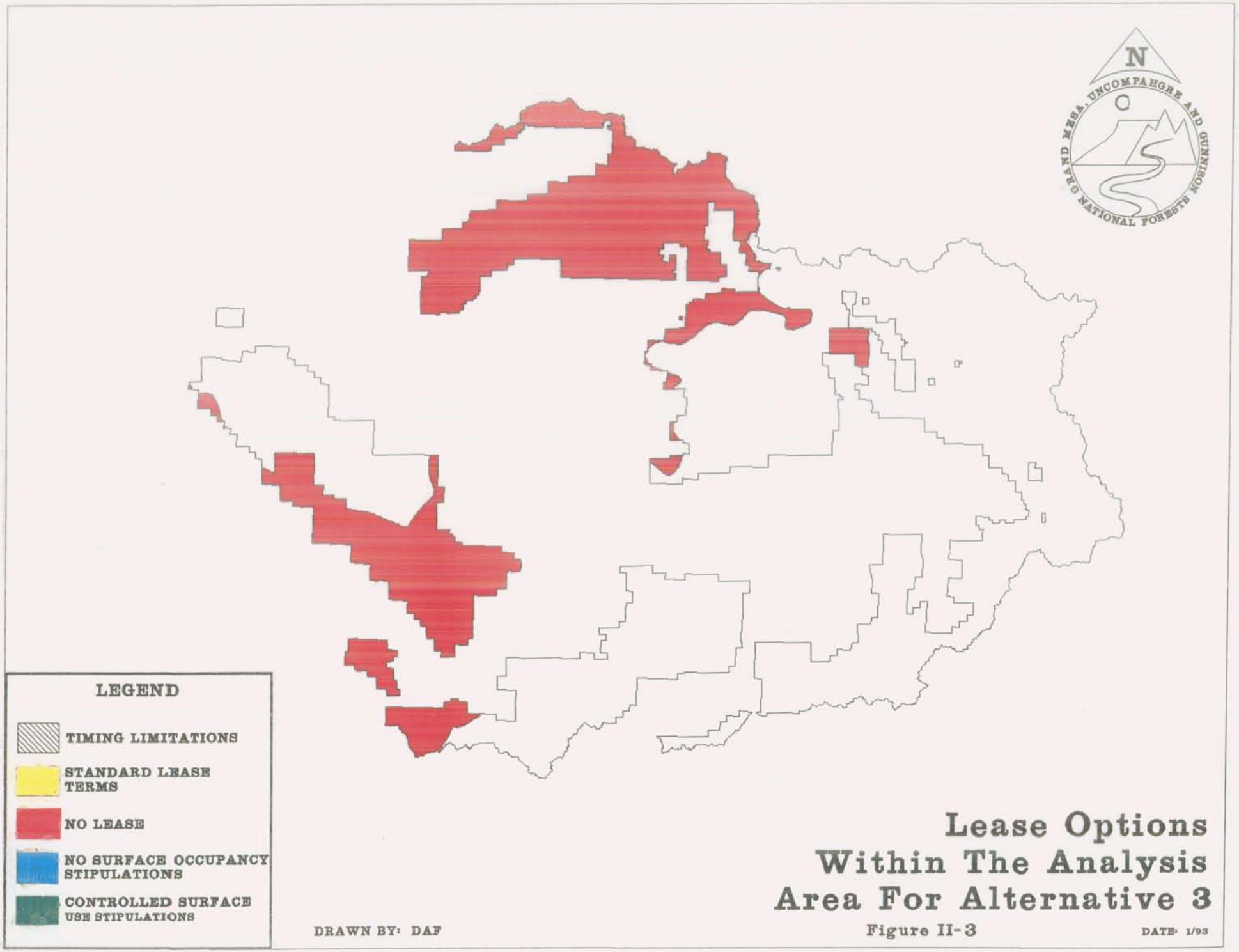
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TIMING LIMITATIONS
STANDARD LEASE TERMS
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Lease Options Within The Analysis Area For Alternative 3
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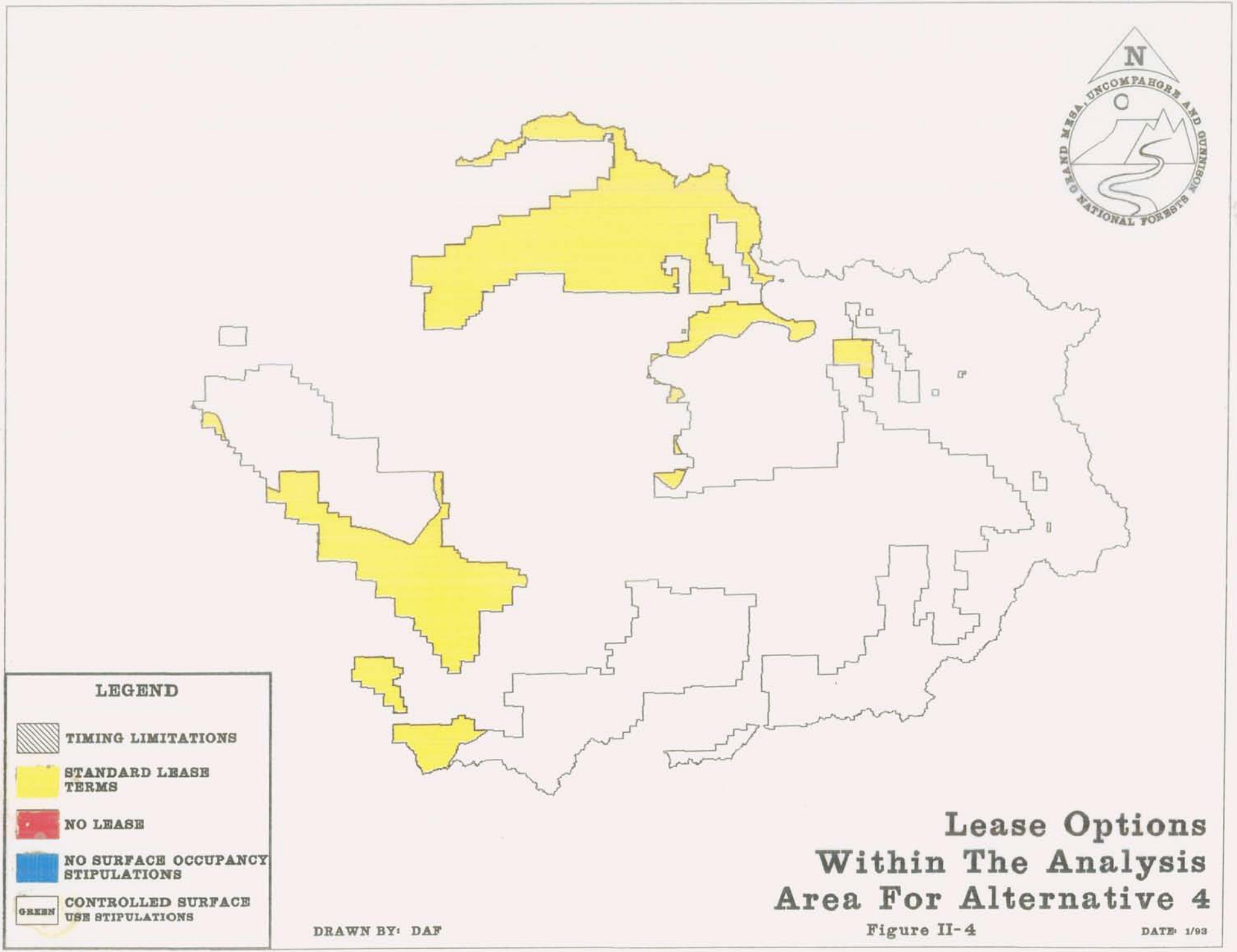
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GRAND MESA, UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS
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TIMING LIMITATIONS
STANDARD LEASE TERMS
NO LEASE
NO SURFACE OCCUPANCY STIPULATIONS
GREEN
CONTROLLED SURFACE USE STIPULATIONS
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Lease Options Within The Analysis Area For Alternative 4
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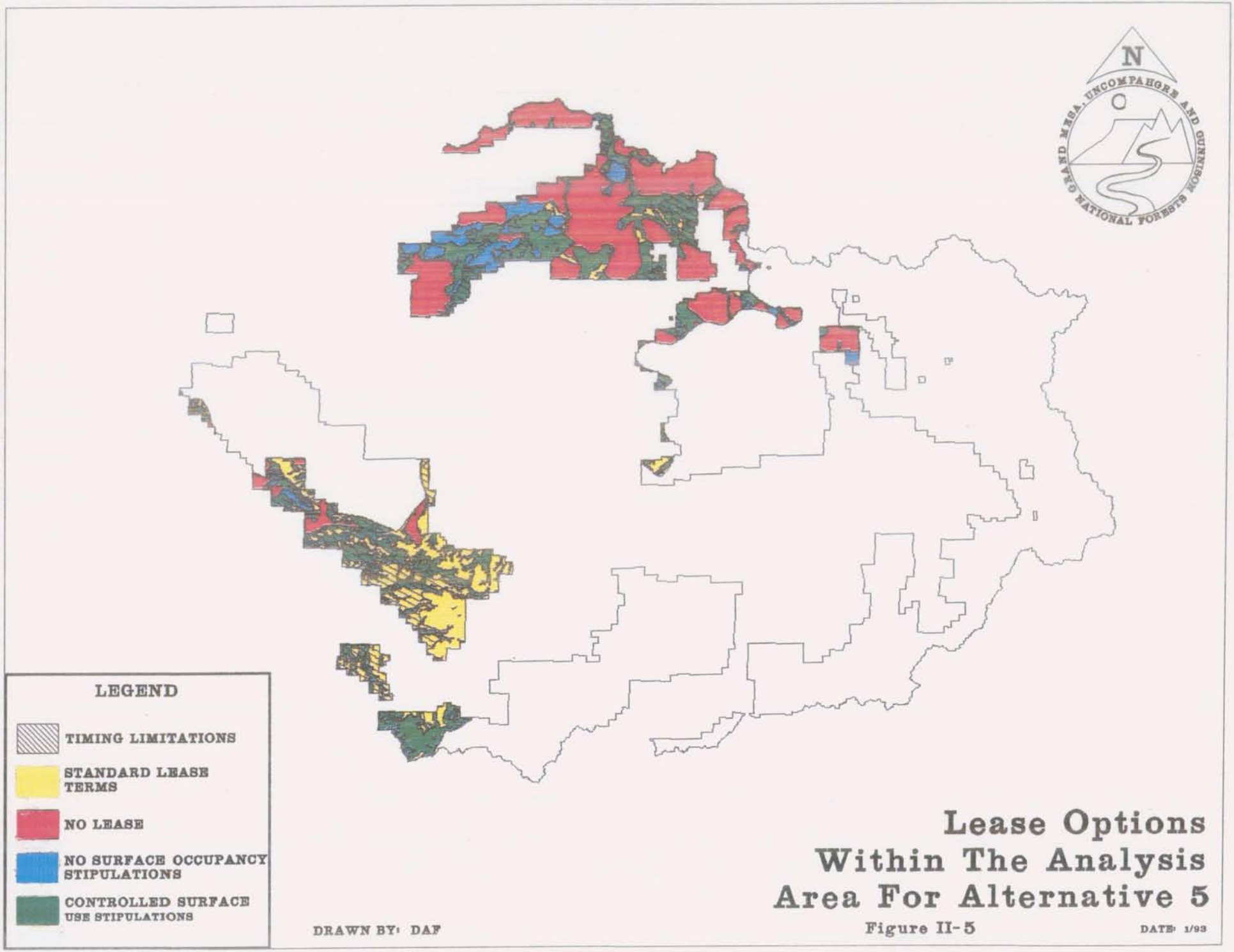
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TIMING LIMITATIONS
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NO LEASE
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CONTROLLED SURFACE USE STIPULATIONS
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Lease Options Within The Analysis Area For Alternative 5
Figure II-5
DATE: 1/93

Chapter III - Affected Environment

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Chapter III - Affected Environment

Introduction

This chapter describes the physical, biological, social, and economic aspects of the Forest's environment.

The Affected Environment section of a FEIS is intended to describe the environment of the area that may be affected by the Alternatives under consideration. 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 - Environmental Consequences, to consider the consequences of the Alternatives in terms of that resource or issue area. Figures referenced are displayed at the end of this chapter.

An important part of the "existing situation" is the demand analysis for oil and gas resources. This analysis is represented in detail in the Reasonably Foreseeable Development (RFD) Scenario prepared by the Bureau of Land Management Colorado State Office, presented in summary in this chapter and appended in full detail as Appendix E.

The Analysis Area

Figure III-1 is a map at small scale of the area considered in this analysis. The maps included in the map packet as part of this FEIS portray the analysis area at a much larger scale.

Not all of the Forest is included in this analysis. Identification of the analysis area was based on a combination of two factors: 1) Oil and gas resource potential (discussed below); 2) Forest Service policy found in Interim Directive 2820-91-1 (Appendix A)

Only those areas of the Forest with moderate and high potential for oil and gas resources, and those areas of low and no known potential for oil and gas resources in which an interest in leasing has been shown are included in the analysis area. (A two mile zone beyond the boundary of the leased parcels in the low and no known potential for oil and gas resources is also included in the analysis area.) Interest in leasing is defined as: an expression by the oil and gas industry that they have an interest in leasing; there has been oil and gas production nearby; the geologic environment is favorable for oil and gas to have accumulated; there are State, private, or Federal leases in the vicinity; geophysical exploration has been done recently; or the BLM indicates that lands have been nominated for lease (Interim Directive 2820-9-1; 2822.94a, Appendix A).

This limitation of the analysis area was done to reduce costs and speed up the analysis. Areas of real interest which can reasonably be expected to be subject to leasing in the near future, are addressed.

Specifically, the analysis area includes all of the Collbran Ranger District; most of the Paonia Ranger District; the western fringe of the Uncompahgre Plateau and the Grand Mesa part of the Grand Junction Ranger District; most of the Ouray Ranger District on the Uncompahgre Plateau; and part of the Norwood Ranger District west and north of the Lizard Head Wilderness. Twenty-eight (28) square miles in the Carbon Creek/Carbon Peak area of the Taylor River Ranger District and none of the Cebolla Ranger District is included in the analysis area.

Oil and Gas Potential

The oil and gas potential of the Forest has been determined in accordance with BLM Manual Section 3021 which describes the criteria for determining lands prospectively valuable for oil and gas resources. Lands underlain by sedimentary rocks shall be classified as prospectively valuable for oil and gas on the basis of the thickness and depth of sedimentary rocks, a favorable structural setting, and evidence of oil and gas potential.

In a sedimentary basin, the minimum thickness of sedimentary rocks considered to be prospectively valuable for oil and/or gas is 1,000 feet, unless a thinner sedimentary section is known to be productive.

The lower limit of potentially productive sedimentary rocks is considered to be 35,000 feet below the surface. Areas having a cover of igneous or metamorphic rocks which has flowed or been thrust over sedimentary rock may be classified as prospectively valuable.

Oil seeps, oil and gas shows in well tests, and past or present production constitute direct evidence of oil and gas potential. Indirect evidence may include seismic information, similarity with known producing rocks, or acceptable levels of thermal maturation. Either direct or indirect evidence may be used in classification.

An area can also be rated as to oil and gas potential (BLM Handbook 1624-H). In areas rated as high for the occurrence of oil and gas resources, there is *demonstrated evidence* of: (1) a source rock for the oil and gas, (2) thermal maturation, (3) reservoir strata possessing permeability and/or porosity, and (4) traps OR the area is part of an oil and gas play as defined by the U.S. Geological Survey.

For an area to be rated as having moderate potential for oil and gas resources there must be a *geophysical or geological indication* that the following are present: (1) a source rock, (2) thermal maturation, (3) reservoir strata possessing permeability and/or porosity, and (4) traps.

In those areas of **low** potential for oil and gas resources, there is *specific indications* that one or more of the following are *not* present: (1) a source rock, (2) thermal maturation, (3) reservoir strata possessing permeability and/or porosity, and (4) traps.

The potential for oil and gas resource rating of **none** (no known) requires that the absence of source rock, or thermal maturation or reservoir rock prohibits the occurrence of oil and/or gas.

Figure III-2 displays oil and gas mineral potential as it is now known for the Forest.

The Current Oil and Gas Leasing Program on the Forest

The current oil and gas leasing program on the Forest is described in detail in "Current Situation", on page I-5 and as the Current Management or "No Action" alternative (Alternative 1) in Chapter II. Figure III-3 displays the existing leases.

The Reasonably Foreseeable Development Scenario

The Reasonably Foreseeable Development (RFD) scenario provided to the Forest by BLM staff specialists predicts a total of 47 wells will be drilled within the analysis area from 1991 through 2005. The RFD assumes that drilling activity will continue at the same conservative levels of 1986 to 1990, and constitutes about 3% of the activity on the Western Slope of Colorado. (The RFD is summarized here - see Appendix E for the entire text of the RFD.) The vast majority, 40 of 47, of the predicted wells will be drilled on existing leases.

Twenty (20) of the wells will be drilled in two existing units on existing leases. (This assumes the units will go to full field development). Both of the units are in the North Fork of the Gunnison River drainage. Some of the units overlap onto the White River National Forest and BLM administered lands. However, the 20 wells discussed here are the number of wells that will be drilled in those portions of the units on this Forest. The two exploratory units that will have the drilling activity and the number of wells predicted for each unit is displayed below.

Narrows - 10 wells

Ragged Mountain - 10 wells

Figure III- 4 is a map that shows the location of each unit.

Outside the exploratory units, 27 additional wells are predicted; 12 each on Grand Mesa and in the North Fork of the Gunnison River drainage, and 3 on the Uncompahgre Plateau. Of these 27 wells, an estimated 20 are predicted to be drilled on existing leaseholds. Seven wells are expected to be drilled on new leases.

From the RFD described above, 40 of the 47 wells predicted for the Forest over the period 1991-2005 will be drilled on existing leaseholds. The parcels of National Forest System lands in existing leaseholds are not subject to the decisions made in the ROD for this analysis until the leases expire or are relinquished. Therefore, regardless of the decisions, environmental effects will potentially occur on those leaseholds and mostly in the units described above. These environmental effects are the baseline effects.

Additional effects will occur as a result of the 7 wells predicted to be drilled on new leases.

Affected Environments

The partitioning of the Affected Environment into those areas described in Table II-5, on pages II-9 through II-10, is maintained through this chapter, as well as Chapter IV. In keeping with the objective to present only information pertinent to the decision, all resources are discussed under the general forest environment. Then for each specific *Affected Environment*, only those resources with a unique relationship to that specific environment, are described.

General Forest

Environmental Factor: 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 numbers of wildlife species, but much fewer individuals of some species. This also contributes to the stability of some 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.

The genetic diversity of plant species on the Forest is as great or greater than was found 100 years ago. Influences of man have had little effect on the gene pools of plants. While the vegetative composition of stands of trees and grasses may be changed, there has been no significant *genetic* loss in these species. Wildlife species have suffered a loss of genetic diversity through the sheer losses of numbers of animals at the turn of the century. Populations of elk, deer, bighorn sheep and several other species have recovered over the past 40 years from fairly limited populations, and hence a fairly limited gene pool.

Species Diversity: Species diversity describes the ability to maintain a diversity of plant and animal species.

When any mature or old growth stand of timber is cut, burned or otherwise altered --- 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 woodpecker species, 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.

Currently, the Forest has an abundance of these cavity habitats. Forest stands contain 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.

Large blocks of mature aspen stands have a high level of species diversity (Draft Biological Diversity Analysis, USDA Forest Service Rocky Mountain Region 11/90, page 13). 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. The conifer-invaded aspen stands have a greater species diversity than either a mixed stand or a pure aspen stand. They also provide important hiding cover to big game species during the summer, and during the fall hunting period.

Old growth in ponderosa pine is rare on the Forest, due to a combination of past logging and mountain pine beetle epidemics.

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.

Environmental Factor: Vegetation (Plant Associations)

The plant communities of the Grand Mesa, Uncompahgre, and Gunnison National Forest are closely linked to elevation, exposure, landform, soil, and water influences. They are complex and diverse in location and physical make up.

For resource inventory, predicting responses, monitoring, and description of vegetative potential, classification of climax vegetative communities into plant associations is a tool of significant value. Daubenmire (1952) describes a plant association as "a kind of plant community represented by stands occurring in places where environments are so closely similar that there is a high degree of floristic uniformity in all layers."

Johnston (1987), by applying the concepts described by Daubenmire, has identified the significant plant associations on the Forests. The following discussion and listing of plant associations represents some of the work done by Johnston.

Vegetative plant associations will be stratified into the general groups associated with coniferous forests, deciduous forests, woodlands, shrublands, grasslands, and forblands, with a composite riparian discussion which transcends all broad stratified communities. The plant associations listed under each general category, are listed from the highest elevation to the lowest.

Forest Condition - Deciduous Forests

These are forests which seasonally (annually) shed their leaves. They are characterized by cold moist climate, short growing season, soil moderately well drained and relatively deep. Vegetation is typically located on benches and moist upper slopes.

Plant Associations:

Aspen *(Populus tremuloides)* / Elk Sedge *(Carex geyeri)*
Aspen *(Populus tremuloides)* / Thurber Fescue *(Festuca thurberi)*
Aspen *(Populus tremuloides)* / Kinnikinnick *(Arctostaphylos adenotricha)*
Aspen *(Populus tremuloides)* / Bracken *(Pteridium aquilinum)*
Aspen *(Populus tremuloides)* / Ligusticum *(Ligusticum spp.)*
Aspen *(Populus tremuloides)* / Arizona Fescue *(Festuca arizonica)*
Aspen *(Populus tremuloides)* / Mountain Snowberry *(Symphoricarpos oreophilus)*
Aspen *(Populus tremuloides)* / Saskatoon Serviceberry *(Amelanchier alnifolia)* - Chokecherry *(Padus spp.)*
Narrowleaf Cottonwood *(Populus angustifolia)* / Thinleaf Alder *(Alnus incana)*

Aspen (Populus tremuloides): The aspen vegetation type typically occurs at lower elevations (7,000 - 11,000 feet) interspersed with grasslands, meadows, mountain brush, and other forest types. Aspen stands on the Forest are typically mature to overmature with high disease and mortality levels.

Aspen is important to recreation use. Aspen form, color and texture contribute to the landscape character through edge contrast between aspen and conifer stands, aspen islands in large meadows, and massive textural blocks, with color being a dominant element. Color contrasts with surrounding coniferous vegetation, nonforest areas, bare rock, water and sky. The color change between seasons attracts many forest visits year round.

Many aspen sites support a luxuriant understory of forbs and grasses, which are used by a large segment of the livestock industry in western Colorado. These sites are important summer range lands for both cattle and sheep.

The aspen ecosystem is important to Colorado wildlife. Deer and elk use aspen under six feet in height for forage. They use taller aspen for thermal and hiding cover. Aspen stands are usually in close proximity to conifer stands that can provide cover during aspen regeneration. Aspen sprouts above snow-cover are critical to winter diet in some areas. The grass, forb, and shrub understory provide a summer food source, as more forage is present than in conifer stands. Aspen forests are prime elk calving and deer fawning habitat. This is especially true on south slopes within 1/4 mile of water, between winter and summer range. Young aspen stands in transitory big game range helps support the animals longer in the spring and fall, taking pressure off summer and winter range and providing extra forage during mild winters.

More songbirds are normally observed in aspen forests than in coniferous forests. Aspen and the associated understory provides food, nest sites, and cover for a variety of birds. Small mammals such as shrews, moles and mice use aspen forests. Overmature aspen stands are usually decadent and provide cavities and insects for bird and mammal species. Aspen along riparian zones is the basic food for beaver.

Aspen regenerates almost exclusively through root sprouting, which usually requires a major disturbance that results in the removal of most or all of the existing trees. Wildfire has historically been the primary disturbance initiating root sprouting, although clearcutting is becoming more prevalent. Sprouting results in clones which are genetically identical to the trees from which they originated; and therefore, have similar characteristics. Characteristics often vary widely between clones, due to genetic and site differences.

Aspen forests have been "managed" for more than 100 years on the Forest. Human management of the forests has influenced the vertical diversity of these stands. Most aspen stands are naturally "even-aged" and 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 timber 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**	**PERCENT (%)**
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 - Coniferous Forests

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 with 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 forest 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.

Subalpine Forest: Elevations 11,200-12,300 feet. Subalpine forest-alpine tundra interface, forming the krummholz forest. Subalpine fir (*Abies lasiocarpa*) and Engelmann Spruce (*Picea engelmannii*) dwarfed or shrub like.

Plant Association:

Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce (*Picea engelmannii*) / Grayleaf Willow (*Salix glauca*).

Montane/Subalpine Forest: Elevations above 9,000, near timberline and below.

Plant Associations:

Bristlecone Pine *(Pinus aristata)* / Thurber Fescue *(Festuca thurberi)*
Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce *(Picea engelmannii)* / Rocky Mtn. Whortleberry *(Vaccinium myrtillus)*
Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce *(Picea engelmannii)* / Current *(Ribes spp.)*
Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce *(Picea engelmannii)* / Heartleaf Arnica *(Arnica cordifolia)*
Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce *(Picea engelmannii)* / Arrowleaf Groundsel *(Senecio triangularis)*

Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce *(Picea engelmannii)* / Elk Sedge *(Carex geyeri)*
Lodgepole Pine *(Pinus contorta)* / Grouse Whortleberry *(Vaccinium scoparium)*
Lodgepole Pine *(Pinus contorta)* /Common Juniper *(Juniperus communis)*
Engelmann Spruce *(Picea engelmannii)* / Moss
Lodgepole Pine *(Pinus contorta)* / Elk Sedge *(Carex geyeri)*
Bristlecone Pine *(Pinus aristata)* / Arizona Fescue *(Festuca arizonica)*
Ponderosa Pine *(Pinus ponderosa)* / Arizona Fescue *(Festuca arizonica)* (rare)

Montane Forest: Elevations generally below 9,000 feet.

Plant Associations:

Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce *(Picea engelmannii)* / Common Juniper *(Juniperus communis)*
Bristlecone Pine *(Pinus aristata)* / Common Juniper *(Juniperus communis)*
Douglas Fir *(Pseudotsuga menziesii)* / Kinnikinnick *(Arctostaphylos adenotricha)*
Douglas Fir *(Pseudotsuga menziesii)* / Myrtle Pachistima *(Paxistima myrsinites)*
Douglas Fir *(Pseudotsuga menziesii)* / Idaho Fescue *(Festuca idahoensis)*
Douglas Fir *(Pseudotsuga menziesii)* / Engelmann Spruce *(Picea engelmannii)* / *(Calamagrostis spp.)*
Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce *(Picea engelmannii)* / moss
Colorado Blue Spruce *(Picea pungens)* - Douglas Fir *(Pseudotsuga menziesii)* / Arizona Fescue *(Festuca arizonica)*
Subalpine Fir *(Abies lasiocarpa)* / Elk Sedge *(Carex geyeri)*
Lodgepole Pine *(Pinus contorta)* / Rocky Mtn. Whortleberry *(Vaccinium myrtillus)*
Douglas Fir *(Pseudotsuga menziesii)* / Elk Sedge *(Carex geyeri)*
Douglas Fir *(Pseudotsuga menziesii)* / Cliff Jamesia *(Jamesia americana)*
Douglas Fir *(Pseudotsuga menziesii)* / Antelope Bitterbrush *(Purshia tridentata)*
Limber Pine *(Pinus flexilis)* / Common Juniper *(Juniperus communis)*
Limber Pine *(Pinus flexilis)* / Thurber Fescue *(Festuca thurberi)*
Ponderosa Pine *(Pinus ponderosa)* / Idaho Fescue *(Festuca idahoensis)*
Douglas Fir *(Pseudotsuga menziesii)* / Greenleaf Manzanita *(Arctostaphylos patula)*
Ponderosa Pine *(Pinus ponderosa)* / Gambel Oak *(Quercus gambelii)*
Ponderosa Pine *(Pinus ponderosa)* / Greenleaf Manzanita *(Arctostaphylos patula)*

Engelmann Spruce/Subalpine Fir (Picea engelmannii/Abies lasiocarpa): The Engelmann spruce and subalpine fir type occurs at high elevations and represents the climax on the majority of the sites it occupies. It usually occupies moist sites. Spruce can grow to over 300 years and fir to 250 years. There is currently a skewed distribution of age classes or structural stages. Sixty percent of the type is overmature, but occasionally stands occur in 2, 3, or multi-story stands. It's dense forest growth and layered appearance provides outstanding scenic views. It is also valued for wildlife habitat, watershed protection and production, and wood products.

As the spruce and fir type matures, the trees become susceptible to insect and disease infestations. Subalpine fir is infected first, followed by spruce.

The spruce/fir type reproduces by seed. It will reproduce itself naturally if not treated. The reproduction will retain the same age class distribution as currently exists. If a natural catastrophe occurs such as a major fire, the site will probably revert to aspen or lodgepole pine.

Ponderosa pine (Pinus ponderosa): This vegetation type is located almost entirely on the Uncompahgre Plateau, between 7,000 and 9,000 feet. Ponderosa pine usually grows in pure stands, but can be associated with aspen and oak brush. Although occurring rather infrequently, natural regeneration requires the combination of a good seed crop, favorable seedbed condition, and ample

moisture the spring following seed fall (and several subsequent springs), to assure germination and seedling survival.

Historically, low-intensity wildfires burned through ponderosa pine stands at frequent intervals. These fires had little effect on established trees since the thick bark makes ponderosa pine somewhat fire resistant. Fires prevented the buildup of heavy duff accumulations, kept competing vegetation in check, and maintained seedbed conditions favorable to ponderosa pine. Fire suppression over the past several decades has resulted in a buildup of organic litter, making seedbed conditions less favorable for ponderosa pine. Currently the type is mature to overmature, open grown and poorly stocked. There are some uneven aged stands which are the result of past cutting activity.

Ponderosa pine is important for timber harvest, livestock grazing, and wildlife habitat. Elk Calving Areas can be located in this type, at lower elevations.

Ponderosa pine is considered a climax species on many of the sites on which it occurs, particularly near the center of its elevational range. Major disturbances, such as high-intensity fires, heavy logging, or widespread mortality from insect or disease infestations may cause ponderosa pine sites to revert to lower seral stages such as aspen, oak brush or grass. The mountain pine beetle is currently at epidemic levels in some localized areas, but the rate of spread generally appears to be decreasing.

Douglas-fir (Pseudotsuga menziesii): The Douglas-fir type typically occurs on steep, north-facing slopes at lower elevations and is frequently the only conifer vegetation in a large area. On south-facing slopes, Douglas-fir occurs sparsely on rocky ridges, steep hillsides, and canyon slopes.

Douglas-fir is a long-lived species which is valued for wildlife habitat diversity, scenic quality, and cover on big game winter range. Douglas-fir also contributes to watershed protection and is a desired commercial tree species. The Douglas-fir type has been treated in the past, resulting in mostly mature and overmature stands. Very little acreage of early successional stages of Douglas-fir are known to exist on the Forest.

Douglas-fir is a climax species that reproduces from seed. Currently the stands have a relatively uniform age structure. Natural succession will perpetuate the current uniform distribution.

Lodgepole pine (Pinus contorta): Lodgepole pine occurs on the Forest primarily in even-aged stands of fire origin. Lodgepole pine is an aggressive pioneer into disturbed sites, but is typically a seral species which, in the long-term absence of major disturbance, will be replaced by more shade-tolerant species--generally Engelmann spruce and subalpine fir. On some sites, however, where site conditions or lack of a seed source prevent the establishment of more shade tolerant species, lodgepole may form a virtual climax. Lodgepole pine provides scenic beauty, wildlife habitat, firewood and other wood products.

As lodgepole pine matures and loses vigor, it becomes highly susceptible to attack by the mountain pine beetle. Mistletoe also heavily infects large amounts of lodgepole pine on the Forest. All of the suitable lodgepole pine stands occur on the Gunnison National Forest. Following disturbance, natural regeneration is often so prolific that the stand is overstocked to a level that growth ceases if it is not thinned.

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. 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.

Old Growth Inventory: 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. Alternative 1A in Figures IV-1 through IV-4, pages IV-14 through IV-17 in the FSEIS for the Amendment of the Land and Resource Plan, Grand Mesa, Uncompahgre and Gunnison National Forests, 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.

Forest Condition - Woodlands

Woodlands are open canopy Pinyon-Juniper forests, characterized by relatively small trees with rounded crowns, adapted to low precipitation, and shallow rocky soils.

Plant Associations:

Pinyon Pine *(Pinus edulis)* - Utah Juniper *(Juniperus osteosperma)* / Mountain Big Sagebrush *(Artemisia tridentata)*
Utah Juniper *(Juniperus osteosperma)* / Fremont Mahonia *(Mahonia fremontii)*
Utah Juniper *(Juniperus osteosperma)* / Indian Ricegrass *(Oryzopsis hymenoides)*
Utah Juniper *(Juniperus osteosperma)* / Pinyon Pine *(Pinus edulis)* / Bluebunch Wheatgrass *(Roegneria spicata)*

Pinyon / Juniper (Pinus edulis / Juniperus osteosperma): This vegetation type is a scrub woodland composed of pinyon pine and juniper. It is a widespread type generally occupying the lowest elevations on the Forest (5500 to 7000 feet), below the elevation limit of Gambel oak. Since the pinyon-juniper

type occurs on the driest sites on the Forest, it is the least productive type. Vegetation is characterized by small size and low growth rate.

It provides forage for wildlife and livestock, adds scenic variety to the landscape, and furnishes products such as firewood, posts, and Christmas trees. It is important cover on Big Game Winter Range. Most of the type is estimated to be in the intermediate and late structural stages which reflects the lack of recent natural disturbance. Grazing has destroyed much of the small sized understory.

Forest Condition - Shrublands

Shrublands consist of woody, deciduous, vegetation ranging in height from several inches to 12-14 feet. Shrublands are widely distributed from elevations less than 6,000 feet to over 12,000 feet. Plant form, soil type, landform, and climate vary significantly over the broad range of shrubland plant associations.

Plant Associations:

Grayleaf Willow *(Salix glauca)* - Willows *(Salix spp.)* / Sedges *(Carex spp.)*
Golden Avens *(Dryas octopetala)* / Rock Sedge *(Carex rupestris)*
Grouse Whortleberry *(Vaccinium scoparium)* - Dwarf Blueberry *(V. cespitosum)* / Alpine Sandwort *(Lidia biflora)*
Golden Avens *(Dryas octopetala)* / Netleaf Willow *(Salix reticulata)*
Planeleaf Willow *(Salix phylicifolia)* / Cliff Sedge *(Carex scopulorum)*
Planeleaf Willow *(Salix phylicifolia)* / Water Sedge *(Carex aquatilis)*
Grayleaf Willow *(Salix glauca)*-Barren Ground Willow *(Salix brachycarpa)* / Tufted Hairgrass *(Deschampsia cespitosa)*
Gooseberry Current *(Ribes montigenum)* / Skunkleaf Polemonium *(Polemonium pulcherrimum)*
Common Juniper *(Juniperus communis)* - Current *(Ribes spp.)* / Thurber Fescue *(Festuca thurberi)*
Bog Birch *(Betula glandulosa)* / Skunkleaf Polemonium *(Polemonium pulcherrimum)*
Planeleaf Willow *(Salix phylicifolia)* / Elkslip Marshmarigold *(Caltha leptosepala)*
Shrubby Cinquefoil *(Pentaphylloides floribunda)* / Yellowdot Saxifrage *(Ciliara austromontana)l*
Dwarf Blueberry *(Vaccinium cespitosum)* / Pine Dropseed *(Blepharoneuron tricholepis)*
American Red Raspberry *(Rubus idaeus)* / Colorado Columbine *(Aquilegia coerulea)*
Bog Birch *(Betula glandulosa)* / Cliff Sedge *(Carex scopulorum)*
Mountain Big Sagebrush *(Artemisia tridentata)* / Thurber Fescue *(Festuca thurberi)*
Shrubby Cinquefoil *(Pentaphylloides floribunda)* / Thurber Fescue *(Festuca thurberi)*
Gambel Oak *(Quercus gambelii)* / Mountain Snowberry *(Symphoricarpos oreophilus)*
Gambel Oak *(Quercus gambelii)* / Saskatoon Serviceberry *(Amelanchier alnifolia)*
Mountain Big Sagebrush *(Artemisia tridentata)* / Idaho Fescue *(Festuca idahoensis)*
Silver Sagebrush *(Artemisia cana)* / Thurber Fescue *(Festuca thurberi)*
Thinleaf Alder *(Alnus incana)* - Drummond Willow *(Salix drummondiana)* / Field Horsetail *(Equisetum arvense)*
Wax Current *(Ribes cereum)* / Idaho Fescue *(Festuca idahoensis)*
Skunkbush Sumac *(Rhus aromatica)* / Mountain Muhly *(Muhlenbergia montana)*
Bush Rockspirea *(Holodiscus dumosus)* / Wax Current *(Ribes cereum)*
Drummond Willow *(Salix drummondiana)* / Bluejoint Reedgrass *(Calamagrostis canadensis)*
American Red Raspberry *(Rubus idaeus)* / Littleleaf Alumroot *(Heuchera parvifolia)*
Bearberry Honeysuckle *(Distegia involucrata)* / Bluejoint Reedgrass *(Calamagrostis canadensis)*

Saskatoon Serviceberry *(Amelanchier alnifolia)* - Chokecherry *(Padus virginianus)* / American Vetch *(Vicia americana)*

Chokecherry *(Padus virginianus)* - Mountain Snowberry *(Symphoricarpos oreophilus)* / Wheatgrass *(Elymus spp.)*

Gambel Oak *(Quercus gambelii)* - Chokecherry *(Padus virginianus)* / Thurber Fescue *(Festuca thurberi)*

Shrubby Cinquefoil *(Pentaphylloides floribunda)* / Thurber Fescue *(Festuca thurberi)*

Red-osier Dogwood *(Swida sericea)* / Bearberry Honeysuckle *(Distegia involucrata)*

Geyer Willow *(Salix geyeriana)* - Willows *(Salix spp.)* / Bluejoint Reedgrass *(Calamagrostis canadensis)*

Antelope Bitterbrush *(Purshia tridentata)* - Mountain Big Sagebrush *(Artemisia tridentata)* / Idaho Fescue *(Festuca idahoensis)*

Red-osier Dogwood *(Swida sericea)* / Whitestem Gooseberry *(Ribes inerme)*

Thinleaf Alder *(Alnus incana)* / Red-osier Dogwood *(Swida sericea)*

Serviceberry spp. *(Amelanchier spp.)* / Mountain Snowberry *(Symphoricarpos oreophilus)* - Mountain Big Sagebrush *(Artemisia tridentata)*

Mountain Snowberry *(Symphoricarpos oreophilus)* / Thurber Fescue *(Festuca thurberi)*

Squaw Apple *(Peraphyllum ramosissimum)* - Mountain Snowberry *(Symphoricarpos oreophilus)* / Mahonia *(Mahonia spp.)*

Gambel Oak *(Quercus gambelii)* - Chokecherry *(Padus virginianus)* / Myrtle Pachistima *(Paxistima myrsinites)*

Gambel Oak (Quercus gambelii): The oak brush vegetation type commonly occurs at lower elevations on the Forest. At its lower elevation range, it is frequently associated with the pinyon-juniper vegetation type. At its upper elevation range, it is often interspersed with aspen, Douglas-fir, or ponderosa pine. Currently, the majority of the Gambel oak type is estimated to be in an early seral stage.

The Gambel oak type provides watershed protection, retards snowmelt, provides browse for wildlife and domestic stock, and is a popular firewood species. Gambel oak is capable of reaching tree size on some sites. This savannah type provides highly productive usable forage for wildlife and livestock. The mature trees provide cavities for small mammal dens and non-game bird nests. Food production for deer and turkey is highest on these sites. When Gambel oak stands are thick, animal mobility is severely restricted and the more palatable grasses and forbs are shaded out.

Mountain Shrub: This vegetation type is dominated by one or more of the following species: serviceberry, rabbitbrush, snowberry, and mountain-mahogany. It is located in combination with other brush types and some of the drier forest types. The primary value of the type is for wildlife habitat and domestic sheep range. It has particular importance when available for use as Big Game Winter Range. There is a significant imbalance in the structural stages on the Forest, with most of the type in intermediate and late stages.

Forest Condition - Grasslands

Of all the plants of the earth, grasses are of the greatest good to the human race, as well as contributing significantly to the habitat requirement of a multitude of wildlife species. The fibrous root systems and resilient stems and leaves provide excellent soil holding capabilities, which results in reduced sedimentation and improved water quality.

They also represent one of the most widely distributed families of flowering plants on the Forests, existing from the xeric landscapes of the cold desert, to the mesic alpine tundra along the crest of the Rockies. Different grasses, like other kinds of plants, thrive best under certain conditions of soil, moisture, temperature, exposure, and altitude.

Each grass species is found growing over a rather definite geographic area, but within this area it is confined to its particular habitat.

In mountain regions, altitude is an important factor in modifying the range of various species. Each species thrives within certain limits of altitude and can predictably be found on adjacent mountain ranges in similar habitats and similar elevations.

Plant Associations:

Blackroot Sedge *(Carex elynoides)* / Golden Avens *(Acomastylis rossii)*
Tufted Hairgrass *(Deschampsia cespitosa)* / Golden Avens *(Acomastylis rossii)*
Rock Sedge *(Carex rupestris)* / Bellard Kobresia *(Kobresia myosuroides)*
Blackroot Sedge *(Carex elynoides)* / Whiproot Clover *(Trifolium dasyphyllum)*
Siberian Kobresia *(Kobresia sibirica)* / Viviparous Bistort *(Bistorta vivipara)*
Cliff Sedge *(Carex scopulorum)* / Elkslip Marshmarigold *(Caltha leptosepala)*
Rock Sedge *(Carex rupestris)* / Alpine Sandwort *(Lidia biflora)*
Bellard Kobresia *(Kobresia myosuroides)* / Golden Avens *(Acomastylis rossii)* - Rock Sedge *(Carex rupestris)*
Hepburn Sedge *(Carex nardina)* / Alpine Kittentails *(Besseya alpina)*
Blackroot Sedge *(Carex elynoides)* / Spikemoss Selaginella *(Selaginella densa)*
Cloud Sedge *(Carex haydeniana)* / Arctic Bluegrass *(Poa arctica)*
Engelmann Sedge *(Carex engelmannii)* / Netleaf Willow *(Salix reticulata)*
Purple Pinegrass *(Calamagrostis purpurascens)* / Morton Alpine Oat *(Helictotrichon mortonianum)*
Blackroot Sedge *(Carex elynoides)* / Oreoxis *(Oreoxis spp.)*
Tufted Hairgrass *(Deschampsia cespitosa)* / Drummond Rush *(Juncus drummondii)*
Drummond Rush *(Juncus drummondii)* / Sibbaldia *(Sibbaldia procumbens)*
Silvertop Sedge *(Carex foenea)* / Golden Avens *(Acomastylis rossii)*
Water Sedge *(Carex aquatilis)* / Elephant Head Lousewort *(Pedicularis groenlandica)*
Black Alpine Sedge *(Carex nigricans)* / Rushes *(Juncus spp.)*
Purple Pinegrass *(Calamagrostis purpurascens)* / Greenland Bluegrass *(Poa glauca)*
Pyrenea Sedge *(Carex pyrenaica)* / Blackheaded Fleabane *(Erigeron melanocephalus)*
Timber Danthonia *(Danthonia intermedia)* / Tufted Hairgrass *(Deschampsia cespitosa)*
Thurber Fescue *(Festuca thurberi)* / American Vetch *(Vicia americana)* - Aspen Peavine *(Lathyrus leucanthus)*
Thurber Fescue *(Festuca thurberi)* / Alpine Oreoxis *(Oreoxis alpina)*
Water Sedge *(Carex aquatilis)* / Beaked Sedge *(Carex utriculata)*
Timber Danthonia *(Danthonia intermedia)* / Varileaf Cinquefoil *(Potentilla diversifolia)*
Teachers Sedge *(Carex praeceptorum)* / Water Sedge *(Carex aquatilis)*
Timber Danthonia *(Danthonia intermedia)* / Letterman Needlegrass *(Stipa lettermanii)*
Idaho Fescue *(Festuca idahoensis)* / Slender Wheatgrass *(Elymus trachycaulus)*
Bluejoint Reedgrass *(Calamagrostis canadensis)* - Cliff Sedge *(Carex scopulorum)* / Bluebells *(Mertensia spp.)*
Tufted Hairgrass *(Deschampsia cespitosa)* / Sedges *(Carex spp.)*
Parry Danthonia *(Danthonia parryi)* / Idaho Fescue *(Festuca idahoensis)*
Thurber Fescue *(Festuca thurberi)* / Parry Danthonia *(Danthonia parryi)*
Rough Fescue *(Festuca scabrella)* / Idaho Fescue *(Festuca idahoensis)*
Tufted Hairgrass *(Deschampsia cespitosa)* / Elkslip Marshmarigold *(Caltha leptosepala)*
Thurber Fescue *(Festuca thurberi)* / Arizona Fescue *(Festuca arizonica)*
Arizona Fescue *(Festuca arizonica)* / Mountain Muhly *(Muhlenbergia montana)*

Water Sedge *(Carex aquatilis)* / Hood Sedge *(Carex hoodii)*
Baltic Rush *(Juncus arcticus)* / Sedges *(Carex spp.)*
Mountain Muhly *(Muhlenbergia montana)* / Arizona Fescue *(Festuca arizonica)*
Parry Danthonia *(Danthonia parryi)* / Arizona Fescue *(Festuca arizonica)*
Tufted Hairgrass *(Deschampsia cespitosa)* / Slender Wheatgrass *(Elymus trachycaulus)*
Mountain Muhly *(Muhlenbergia montana)* / Lanceleaf Bluebells *(Mertensia lanceolata)*
Brookgrass *(Catabrosa aquatica)* / Water Sedge *(Carex aquatilis)*

Forest Condition - Forblands

Forbs are characterized by herbaceous, broad leafed plants, that are primarily non-dominant in a plant association, subsequently they represent important indicators within other plant associations. True forb dominated climax vegetation is primarily limited to the Alpine and Sub-Alpine plant communities.

Because of the tender and succulent nature of most forbs, they provide a significant amount of wildlife forage, especially during the time of lactation or the rearing of broods.

Plant Associations:

Netleaf Willow *(Salix reticulata)* / Golden Avens *(Acomastylis rossii)*
Heartleaf Bittercress *(Cardamine cordifolia)* / Elkslip Marshmarigold *(Caltha leptosepala)*
Dwarf Clover *(Trifolium nanum)* / Alpine Sandwort *(Lidia biflora)*
Dwarf Clover *(Trifolium nanum)* / Pinnate Fleabane *(Erigeron pinnatisectus)*
Parry Clover *(Trifolium parryi)* / Golden Avens *(Acomastylis rossii)*
Golden Avens *(Acomastylis rossii)* / American Bistort *(Bistorta bistortoides)*
Alpine Springbeauty *(Claytonia megarhiza)* / Moss Silene *(Silene acaulis)*
Combleaf *(Smelowskia calycina)* / Northern Wormwood *(Artemisia borealis)*
Arctic Willow *(Salix arctica)* / Parry Clover *(Trifolium parryi)*
Alpine Twinpod *(Physaria alpina)* / Harbours Penstemon *(Penstemon harbourii)*
Colorado Eriogonum *(Eriogonum coloradense)* / Droppod Crazyweed *(Oxytropis deflexa)*
Parry Primrose *(Primula parryi)* / Tufted Hairgrass *(Deschampsia cespitosa)*
Gordon Ivesia *(Ivesia gordonii)* / Fendler Sandwort *(Eremogone fendleri)*
Netleaf Willow *(Salix reticulata)* / Dwarf Blueberry *(Vaccinium cespitosum)*
Arctic Willow *(Salix arctica)* / Blackheaded Fleabane *(Erigeron melanocephalus)*
Whiproot Clover *(Trifolium dasyphyllum)* / Alpine Sandwort *(Lidia biflora)*
Alpine Pussytoes *(Antennaria media)* / Arctic Bluegrass *(Poa arctica)*
Sibbaldia *(Sibbaldia procumbens)* / Alpine Sandwort *(Lidia biflora)* - Moss
Parry Clover *(Trifolium parryi)* / Tufted Hairgrass *(Deschampsia cespitosa)*
Porter Ligusticum *(Ligusticum porteri)* / Lodgepole Lupine *(Lupinus parviflorus)*
Sticky Polemonium *(Polemonium viscosum)* / Pinnate Fleabane *(Erigeron pinnatisectus)*
Elkslip Marshmarigold *(Caltha leptosepala)* / Rosecrown Stonecrop *(Clementsia rhodantha)*
Black Groundsel *(Senecio atratus)* / Varileaf Phacelia *(Phacelia heterophylla)*
Corn Husk Lily *(Veratrum tenuipetalum)* / Common Cowparsnip *(Heracleum sphondylium)*
Mountain Bluebells *(Mertensia ciliata)* / Tufted Hairgrass *(Deschampsia cespitosa)*
Yellowdot Saxifrage *(Ciliara austromontana)* / *Brittle Bladderfern (Cystopteris fragilis)*

Forest Condition - Undesirable Plants

Where significant impacts from timber harvesting, road building, livestock, wildlife, or other physical forces have resulted in land disturbance and changes in the plant species composition of the ecosystem, competitive, non-native, and generally less desirable plants often invade. Examples of undesirable plant species which inhabit the study area and give cause for concern include: Bluegrass (*Poa pratensis*), Canada Thistle (*Cirsium arvense*), Leafy Spurge (*Euphorbia esula*), Musk Thistle (*Carduus nutans*), Russian Knapweed (*Centaurea repens*), Dyer's Woad (*Isatis tinctoria*), and Yellow Toadflax (*Linaria vulgaris*), etc.

Environmental Factor: 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 cross the Rockies. Climate is controlled primarily by four factors: 1) latitude - distance north of the equator; 2) continental position - remoteness from large bodies of water and its proximity to large, varied land masses; 3) elevation - ranging from valleys to mountains; and 4) winter storm track position.

Elevations in the analysis area range from 6,000 feet to 12,613 feet at Lone Cone. 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.

Precipitation in the analysis area ranges from 8 inches at lower elevations to about 40 inches at the higher elevations.

Temperature, like precipitation, varies directly with elevation. In the Colorado River Basin average temperature declines 3.4 $^{\circ}$ F. with each 1000 foot increase in elevation ("Colorado Climate", 1977). The average annual temperature ranges from 50 $^{\circ}$ F. at lower elevations of the analysis area to 36 $^{\circ}$ F. at higher elevations.

The western slope of Colorado is sunny. Grand Junction has sun all or part of the day, 70% of the time. On average, 142 days are clear, 106 days are partly cloudy and 117 days are cloudy. November through May is the time period that tends to be cloudier than average.

Environmental Factor: Geology, Geomorphology and Physiography

The analysis area is situated along the eastern boundary of the Colorado Plateau physiographic province. The Southern Rocky Mountain province is to the east. As a result, a great variety and complexity of landforms, geomorphic situations and geologic material occur within the analysis area. The broad basins, mesas, and canyonlands of the Colorado Plateau blend into the rugged uplifted Rocky Mountains. The geologic material is also a blend. The shales and sandstones of the Colorado Plateau have been locally uplifted and intruded by a variety of igneous materials and locally overlain by volcanics.

The landforms and slopes of the analysis area have also been influenced by shales of varying geologic ages. The predominant shales (primarily the Mancos Shale and shales of the Wasatch Formation) consist of soft, fine-textured clay materials laid down in ancient seas. These soft shales are often unstable, especially when wet, and may give way as a result of management activities (see also the discussion of the High and Moderate Geologic Hazard *Affected Environments*, this chapter pages III-55 to III-56).

With the exception of the deep valley bottoms on the Uncompahgre Plateau (such as along Escalante Creek and Roubideau Creek) where very old granitic rocks are exposed, Grand Mesa which is capped by a series of basaltic lava flows, and the intrusive rocks associated with such geomorphic features as Lone Cone and Little Cone; the analysis area is dominated by the sedimentary rocks of the Colorado Plateau. The following sedimentary rock units have been mapped in the analysis area: The Chinle and Wingate Sandstones, the Entrada, Summerville, and Morrison Formations, the Dakota sandstone, the Mancos Shale, the Mesaverde Group, and the Wasatch and Green River Formations.

The Forest is situated within portions of four U.S. Geological Survey (USGS) petroleum resource assessment provinces. Figure 1 in Appendix E, illustrates those portions of the Uinta-Piceance-Eagle, Paradox, San Juan and Albuquerque-Santa Fe-San Luis basins that are within the Forest.

Conventional oil and gas plays defined by the USGS and present within the Forest, are situated within the Uinta-Piceance-Eagle basins and the Paradox basin (Table 1. in Appendix E). No plays have been identified within the San Juan and Albuquerque-Santa Fe-San Luis basins on the Forest.

In addition to the plays designated by the USGS, the lower and middle Paleozoic section, specifically the Leadville Limestone, constitutes a highly speculative play within the southern Piceance basin. Mobil Oil Corporation is currently drilling a 19,500 foot test of the Leadville, south of the town of Silt. Potential traps include unconformities and stratigraphic pinchouts within the Pennsylvanian age rocks along the margin of the Central Colorado trough.

Hydrocarbon Occurrence

Natural gas was first discovered in the analysis area from sandstones in the Mesaverde Group, in 1958, which was designated as the Grand Mesa Field. The field produced only 741 thousand cubic feet of gas (MCFG) and was abandoned in 1973 (Table 2 in Appendix E). Since that time, three additional fields have been discovered with established production from the Cozzette, Corcoran, and Morapos sandstones, as well as undivided sandstones in the Mesaverde Group.

Methane, a natural gas, is present in the Cameo Coals of the Mesaverde Group. Coal beds have long been recognized as a source of natural gas, but only recently were tax incentives given for the recovery of the methane from coal beds. Several coal bed methane wells have been drilled on the Forest, but none have been completed for production.

Several aspects of coal bed methane production are unique, but most are similar or identical to conventional oil and gas development. The technology and methods utilized to drill and complete coal bed methane wells are essentially the same as those which have been used in the oil and gas industry for many years. The drilling method (rotary), blowout prevention equipment, and casing programs are nearly identical to those used in conventional oil and gas operations. The typical casing job is modified slightly so that sufficient cement can fill the entire space around the casing and restrict fluids to their respective zones.

The methane is contained in coal bed fractures and is attached to micropore surfaces. The methane is held in place in the coal bed by confining pressures. It is released when the confining pressure is reduced. The reduction in confining pressure is achieved by pumping water out of the coal bed. Coal bed methane wells tend to produce a large volume of water (See also Appendix G.) Note that on the fringes of the Piceance Basin, coal bed methane wells do not always produce large volumes of water and the water that is produced is not always salty (personal communication, Jerry Jones, BLM).

Oil and gas production is confined to the most northern portions of the Grand Mesa and the Gunnison National Forests, with no drilling on the Gunnison National Forest, south of Township 12 South. Exploratory drilling has been confined to the high and moderate potential areas within the remainder of the analysis area, specifically along the southeastern margin of the Uncompahgre National Forest (Figure 9 in Appendix E), within the Paradox Basin. Eighteen exploratory wells have been drilled

on the Uncompahgre National Forest since 1949, with no success; however, there have been some oil and gas shows reported (Table 3 in Appendix E).

Prospectively Valuable for Oil and Gas

Land classified as prospectively valuable (PV) for oil and gas is based on criteria described in Appendix E. PV lands for oil and gas within the Forest are shown in Figure 2 in Appendix E, and generally include lands that have a minimum of 1,000 feet of sedimentary rock, favorable structural setting, and minimum evidence of potential for the occurrence of oil and gas. Areas not designated as PV are rated as having no known potential.

Oil and Gas Potential

Oil and gas potential for the area is shown in Figure III-2 and Figure 3 of Appendix E. In general, areas defined by the USGS as a conventional oil and gas play are assigned a high potential, while lands not classified as PV have no known potential. It should be noted that the plays described below occur within two petroleum provinces and do not cross into the other province, since the provinces are defined on administrative, rather than geologic, boundaries.

Spencer and Wilson (1988) describe three major and two unconventional plays as the Permian-Pennsylvanian sandstone, Uinta-Piceance Tertiary gas, and Uinta-Piceance Upper Cretaceous plays, while the unconventional plays are tight gas sands and Cretaceous coal bed methane.

The Permian-Pennsylvanian sandstone play is relatively unexplored and involves stratigraphic pinchouts within the Weber and correlative sandstones, into relatively impermeable redbed sequences. The play as evaluated by the USGS, also includes lands within Utah (Figure 4 in Appendix E) and is estimated to contain from two to ten undiscovered fields that have at least one million barrels of oil (MMBO). The play may cover a larger area that is shown on the map, and is considered to be speculative for the southern Piceance Basin.

The Tertiary conventional gas play (Figure 5 in Appendix E) consists of stratigraphic and structural traps that have been moderately well explored. Most of the Tertiary rocks in the Piceance basin are thermally immature. Tertiary reservoir gas is interpreted as having migrated from upper Cretaceous source beds, located in the Mesaverde Group (Spencer and Wilson, 1988). Conventional Tertiary reservoirs will be found at depths of from less than 3,000 to about 7,000 feet, and are expected to be unconventional and tight at depths greater than 7,000 feet. The USGS estimates that from 9 to 35 fields remain to be discovered with the play.

Figure 6 in Appendix E, illustrates the location of the Upper Cretaceous gas play. Conventional reservoir production is from fluvial and marginal-marine sandstones in both stratigraphic and combination traps at depths of from 2,000 to 5,000 feet. Reservoirs below 5,000 feet are generally tight, which is attributed to paleoburial of 7,000 feet or more (Spencer and Wilson, 1988). The USGS estimates that 25 to 55 reservoirs of 6 billion cubic feet of gas (BCFG) may remain to be discovered within the play.

The areas designated by the Federal Energy Regulatory Commission as being eligible for tight sand gas production price incentives are shown in Figure 7 (in Appendix E). This designation is for gas produced from the lower Mesaverde Group marginal-marine sandstones. This area has a high potential, while the remainder of the Piceance basin within the Forest has a moderate potential.

Coal bed methane resources of the southern Piceance basin have been studied extensively (Cholate, Jurich, and Saulnier, 1984; Johnson and Nuccio, 1986; Rightmire and Cholate, 1986; Tremain, 1984). Areas rated as having low through high potentials for coal bed methane production are shown in Figure 8. The remainder of the Forest is rated as having no known potential for the occurrence of coal bed methane.

Lands rated as having a high potential within the Paradox structural basin are shown in Figure 9 (in Appendix E), and includes the four USGS oil and gas plays illustrated in Table 1 (in Appendix E). The speculative lower Paleozoic play of the Piceance basin is also present within the Paradox, as the buried fault blocks, older Paleozoic, Leadville Limestone and McCraken Sandstone. Oil and gas production from this play is represented by the Lisbon Oil Field. This is the largest field in the play and has an estimated ultimate recoverable reserves of 43 MMBO and 250 BCFG. There are five other smaller fields within the play that do not have significant production. Peterson (1989) notes that it is unlikely that any new fields the size of the Lisbon will be discovered, and that present production indicates that new field discoveries will be small and have low gas BTU values.

The second play in the Paradox is the salt anticline flanks, which includes the Permian Cutler Formation and the Pennsylvanian Honaker Trail Formation of the Hermosa Group. Reservoirs are developed in arkosic sandstones of the Cutler and limestones with minor sandstones in the Honaker Trail, that accumulated as thick (i.e., 2,500 to more than 14,000 feet) in synclines along the margins of salt cored anticlines. The Andy's Mesa Field is the only field in the play to have significant production. Cumulative production through 1990 was 21 MB condensate and 18.4 BCFG, from seven wells (Colorado Oil and Gas Conservation Commission, 1991). Three additional one well fields are present within the play.

The Paradox Formation is the objective of the fractured interbeds play and is situated within the deep trough of the Paradox Basin, and also includes the Paradox fold and fault belt. The reservoir rock consists of fine-grained silty dolomite and dolomitic or calcareous black shale, that is also the source rock. Oil and gas shows are usually encountered during drilling through the interbeds to test deeper objectives. Most of the fields developed in this play were discovered during exploratory drilling for deeper objectives and are one well fields, with the largest having produced about 1.2 MMBO (Peterson, 1989).

The last play within the Paradox is the Silverton Delta, Northeast Basin-Honaker Trail Formation. Potential reservoirs are delta-front sandstones that were deposited along the east flank of the basin. The play is speculative with only one well that had a significant show of gas from the Honaker Trail. Any potential field discoveries are expected to be less than 1 MMBO or 6 BCFG in size (Peterson, 1989).

Drilling activity within the Uncompahgre and Gunnison National Forests has been confined to the high oil and gas potential areas, while 22 wells (13 dry and 9 producers) and 6 dry holes were drilled within the high potential and moderate potential areas, respectively within the Grand Mesa National Forest. No wells have been drilled within the low and no known potential areas.

Environmental Factor: Soil Resources

The soils of the study area are as complex as the landforms and geologic parent material that has helped form them. The specific characteristics that a particular soil will have depends on the interaction of parent material (geology), climate, various living organisms, topography, and time. This is especially true of the canyon, plateau, and mountainous terrain in this analysis area.

Located on the eastern edge of the Colorado Plateau physiographic province and the western edge of the Rocky Mountains, the landforms, geomorphic and geologic situations are very diverse and varied. Add to this the elevational range, vegetation and aspects involved and it's easy to visualize the different soil characteristics that could occur. As a result of these diverse environmental situations, the soil properties of depth, texture, inherent fertility, and age, occur in complex patterns across the landscape. Soil depths vary from shallow on steep canyon sideslopes and ridges, to deep on some upland areas and valley bottoms. Textures range from medium textured loams to fine textured silt loams, silty clays and clays, with varying degrees of coarse fragments of basalt on Grand Mesa and chunks of sandstone on the Uncompahgre Plateau. There is a dominance of fine textured soils, a direct product of parent materials of sandstone, shale and mudstone, and interbedded sandstone and shale.

Soils information has been gathered throughout the analysis area as part of the National Cooperative Soil Survey. This was conducted by the Soil Conservation Service from 1979-1992. Soils were inventoried in enough detail to describe the properties, potential limitations and hazards of many kinds of soils. From a study of this information and evaluation of geologic, geomorphic and physiographic information, the analysis area can be grouped into the following four regions:

1. Grand Mesa Top - also includes top of Battlement Mesa

2. Grand Mesa Sideslopes - includes all upper- and mid-slopes of Grand Mesa, Battlement Mesa and the Muddy Basin-Buzzard Divide area

3. Uncompahgre Plateau - covers the southern 1/2 and western fringes of the plateau.

4. Lone Cone - area surrounding and including Lone Cone and Little Cone Peaks.

A brief description of the soil characteristics in these regions follows:

Grand Mesa Top

The soils in this region have developed from the reworking of basaltic material by gravity, glacial ice and water. Some of the most dominant soils include those of the Doughspoon, Grandmesa, Namela, Mulgon, and Needleton soil series (from the Soil Survey of the Grand Mesa-West Elk soil survey area)

The main top of Grand Mesa is a nearly flat tableland with slopes generally under 30%. There are steeper slopes and large expanses of boulder fields around Crag Crest and the very top of Battlement Mesa.

Major soil features include moderate to deep depth classes and medium to fine textures with generally large amounts of rock fragments in the profile (35% by volume). Rock fragments consist of rounded basalt cobbles and boulders. The boulders may be pickup truck size or larger. Often times the subsoil is rather fine textured, with heavy clay loams and clays occurring at depths of 30" and deeper. This results in localized seasonally perched water tables. This occurs mainly in the early part of the growing season, due to infiltration from the melting of heavy winter snows. The perched water tables slowly recede as the season progresses. In general, these soils are of moderate to low fertility. The overall erosion hazard of the majority of this area would be low to moderate. Revegetation may occur slowly because of the harsh growing conditions at these elevations.

Grand Mesa Sideslopes

This region is rather extensive and covers all the flanks of Grand Mesa and Battlement Mesa, along with landforms on the eastern end of Grand Mesa, and in the Porter Mountain, Hightower, and Huntsman Ridge area. It wraps around south and includes the Raggeds, the north slopes of East Beckwith Mountain, the area between the North Fork of the Gunnison and Minnesota Creek, and on the fringes of the Forest near Crawford, Landsend Peak, Saddle Mountain and the western edge of Black Mesa.

The soils in these regions have developed from Tertiary and Cretaceous shales, mudstones, and siltstones, mainly from the Wasatch, Green River, and Mancos formations. Some of the most dominant soils include those of the Wetopa, Wesdy, Taterheap, and McClure soil series, and are associated with the aspen vegetation zone. Also included, but at lower elevations are the Kolob, Fughes, and Herm soils. These occur in the oakbrush zone. Small portions of pinyon-juniper vegetation occur on the very western edge of Grand Mesa and around Landsend Peak. The soils that occur here are within the Agua Fria, Clapper and Chain series.

The landforms in these areas are mainly moderately steep and steep mountain and plateau sideslopes. Large landslide slump blocks occur along the upper portions around the edges of Grand Mesa. The area in general shows much evidence of past mass movement in the form of earthflows, slumps, slides, and mudflows. Some of the more prominent ones are the Lombard slide, the Muddy Basin area, and the McClure Pass mudflow.

Major soil features include deep, dark colored soils that have formed on the residual landforms and the landslide deposits. These soils have high organic matter content in the surface and in most cases have a fine textured subsoil. Generally, these soils are very productive. The overall erosion hazard of the area is moderate to high, due to steep slopes and finer textures. A major limitation in these areas is the susceptibility of the landforms and soils to slope failure. Also the high organic matter content and weakness of the subsoils will not support traffic well when wet. Revegetation success is usually higher in these areas, due to higher fertility of the soil and better growth conditions. The main exception is the soils in the pinyon-juniper areas. These soils have less organic matter and generally more rock fragments on the surface and throughout the profile. Revegetation is harder to accomplish due to a dryer moisture regime.

Uncompahgre Plateau Area

This region covers the southern half of the Uncompahgre Plateau and small fringes on its western edges. Also included is the Naturita Division.

The soils in this region have developed mostly from Cretaceous sandstones, shales and interbedded sandstones and shales of the Dakota and Morrison Formations and the Mancos Shale. Some of the most dominant soils include those of the Ula, Agnesston, Pendergrass, Lamphier, Hapgood, Delson, Kubler, Cerro, Mirand, Arabrab, and Chilson soil families.

The characteristics of these soils vary greatly. Generally, it can be said that they range from shallow to deep and are on the whole, medium to fine textured. Overall erosion hazard is low to moderate, but increases to high on the steeper canyon sideslopes. Revegetation potential varies, depending on the specific area involved, but as a whole can be considered fair. Overall fertility is fair. Some canyon sideslopes are susceptible to slumping and mudflow activity.

The landforms in this area are typical of the canyonlands. They consist of the plateau itself, a high, broad domed upland, dissected by deep steep-walled canyons.

The Lone Cone Area

This area covers the very southwestern portion of the analysis area. It encompasses Lone Cone Peak, Little Cone Peak, and the lands around and in between.

The landform is typical of the canyonlands, with broad smooth uplands, mesas, and plateaus, but in this case they have been domed up and intruded by volcanic material of Tertiary age. The effect is that the peaks of Lone Cone and Little Cone are mountains perched on top of mesas which are dissected by steep walled canyons.

The soils have developed in a mixture of parent materials. In this case it is sandstones and shales on the upland mesas and plateaus, and the canyons, with some influence from the volcanic plugs of granodiorite and rhyolite. Some of the most dominant soils include those of the Callings, Baird Hollow, Tellura, Scout, Seitz, Snowdon,and Needleton soil series, along with large areas of mountain peaks consisting of rock outcrops and talus slopes.

Major soils features vary considerably because of the variety of vegetation, geology, and landforms. But very generally they are deep, medium textured soils. Soil depth decreases on the steeper mountain slopes and amount of coarse fragments increase. Areas that have been influenced by shale parent

material tend to be finer textured. Organic matter is high under aspen vegetation, but decreases as elevation increases. Overall erosion hazard is medium to high with the steeper mountain and canyon slopes being high. Some slumping and earthflow activity has been noticed in areas associated with shale, on slopes greater than 40%, and on canyon sideslopes.

Soil Erosion

The erosion hazard is a rating given to a soil or activity which indicates 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 0.10 - 0.30). 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 the Forest have experienced and continue to experience slope movement. Much of the analysis area is underlain by unstable shales. The shales are softer and weaker, especially when wet, than most of the other geologic materials. All of the following recognized slope failure features can be found in the area: rockfalls, rockslides, debris slides, slumps, earthflows, rotational slides, translational slides, blockslides, and soil creep.

Examples include the upper reaches of the Muddy Creek drainage and the flanks of Grand Mesa. These areas are still experiencing localized slope movement. See the discussion of High and Moderate Geologic Hazards on pages III-55 - III-56 of this chapter.

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 shales and 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 as easily. Often, these less fertile areas occur at elevations above 11,000 feet and at lower elevations between 6,000 and 7,000 feet.

Environmental Factor: Air Quality

Air quality over most of the Forest is good, although a trend of worsening visibility is a growing concern. Impacts from air pollution in this area are mostly associated airborne particulates. However, there is also a potential for air pollution associated with acid deposition.

Air pollution is very mobile and major emission sources hundreds of miles away are capable of impacting air quality on the Forest. The prevailing regional winds through the analysis area is out of the southwest. This means that pollutants will generally migrate toward the northeast.

Visibility is reduced by smog and particulates. The main source of pollutants from Forest activities are, and will continue to be, suspended particulates from wildfire and prescribed burning. Dust from Forest roads and gravel crushing operations are also contributors of particulates. External sources of air pollution are dust from roads, exhaust emissions from internal combustion engines, wood burning stoves, and localized light industry.

Acid deposition, commonly referred to as acid rain, is also an air quality concern of the Forest. Acid deposition occurs when automobile or industrial emissions produce a chemical reaction in the atmosphere that results in acidic precipitation. Over time, input of acid deposition can adversely effect the health of both plant and animal communities. The effects of acid deposition are most pronounced in areas with little vegetation or soil development and a geology of neutral or acidic rock. Typically these are the high alpine areas on the Forest. Areas of sedimentary geology are less vulnerable. The alkaline character of the rock, with pH's greater than 7, have the capability to neutralize acid deposition.

Air Quality Regulation

In 1967 Congress passed the Clean Air Act (42 USC 1857, et seq.) and amendments to the Act were added in 1972, 1977, and 1990. The Act provided for the prevention of significant deterioration (PSD) of air quality. The intent of the PSD is to limit air quality degradation in those areas of the country where the air quality is much better than standards. Through the PSD provisions, Congress 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. National Parks, Wilderness Areas, and certain Indian reservations were designated as Class I airsheds. All areas of the Forest are currently classified Class II except for the

West Elk, La Garita, and Maroon Bells Wilderness. The West Elk Wilderness is located immediately adjacent to the analysis area.

Including the three Wilderness areas mentioned above there are five Class I airsheds in the vicinity of the analysis area. They are the West Elk, La Garita, Weminuche, and the Maroon Bells Wildernesses, and Black Canyon of the Gunnison National Monument. Class I airsheds in the vicinity of the analysis area are displayed on Figure III-30.

NAAQS Criteria Pollutants

The EPA has established the National Ambient Air Quality Standards (NAAQS) for 6 pollutants, known as criteria pollutants (those affecting health):

Carbon Monoxide (CO): Carbon monoxide is strongly related to automobile use and wood burning. The presence of these sources along with poor atmospheric mixing conditions may provide the conditions conducive to producing high concentrations of CO. Highly urbanized areas of the Colorado Front Range and well sheltered mountain valley locations are capable of producing these types of conditions. Denver was the only monitoring station in the state exceeding the NAAQS for CO (only urban areas are monitored for CO). Grand Junction is the only carbon monoxide monitoring site on the Western Slope of Colorado.

Ozone (O_3): Ozone forms as a result of chemical reactions between certain reactive hydrocarbons and nitrogen oxides that react with each other in sunlight. Sources of reactive hydrocarbons include automobile exhaust, gasoline and oil storage and transfer, industrial use of paint solvents, degreasing agents, cleaning fluids and ink solvents, incompletely burned coal or wood, and plants. Nitrogen oxides are emitted by sources when nitrogen in the air combines with oxygen during high temperature combustion. Areas typically affected by ozone are those suburban areas downwind of major urban areas. No monitoring of ozone is done on the Western Slope of Colorado.

Nitrogen Dioxide (NO_2): During high temperature combustion, nitrogen in the air reacts with oxygen to produce nitrogen oxides. Nitrogen dioxide is considered to be the most detrimental of the nitrogen oxides to human health. Sources include power plants, motor vehicles, space heating, aircraft and fireplaces and wood stoves. No monitoring for nitrogen dioxide is done on the Western Slope of Colorado.

Sulfur Dioxide (SO_2): Sulfur dioxide is mainly emitted from stationary sources such as power plants and refineries that burn fossil fuels. Wood, natural gas, propane and other common fuels used for home heating do not contain significant quantities of sulfur and are not considered major sources of sulfur dioxide. Sulfur dioxide can be converted in the atmosphere to sulfuric acid. Monitoring in Colorado is restricted to major metropolitan areas or locations with coal burning power plants where SO_2 emissions are likely. No State monitoring of sulfur dioxide is done on the Western Slope of Colorado.

Particulate Matter (PM10): Particulate matter consists of tiny particles of solid or semi-solid material found in the atmosphere. Particulate matter smaller than 10 microns is referred to as PM10. It is considered inhalable and for that reason is commonly monitored. Particles larger than 10 microns is usually sand and dirt blown by winds from roads, fields, and construction sites. PM10 particulates are generally created during a burning process and include fly ash from power plants, carbon black from motor vehicle engines, and soot from fireplaces and woodstoves. There are several monitoring sites on the Western Slope of Colorado including the following within the 50 kilometers of the analysis area: Delta, Telluride, Crested Butte,Grand Junction, Fruita, Colorado National Monument, Rifle, Glenwood Springs, Aspen, and Molas Pass. Aspen and Telluride are non-attainment areas for PM10. Total Suspended Particulates (TSP) is monitored at Colorado National Monument.

Lead: Lead exists as particulate matter in the PM10 size range. The primary source of lead in the atmosphere is motor vehicles that burn leaded gasoline. Another source is the extraction and

processing of metallic ores. The general trend towards less use of leaded gasolines has resulted in fewer problems with atmospheric lead in Colorado. Emphasis is shifting to monitoring stationary sources. Monitoring sites on the western Slope of Colorado are at Leadville and Mesa Verde. These sites are 60 miles and 36 miles from the analysis area, respectively.

Levels of the above pollutants above the standard are considered unhealthful. Several areas in Colorado have been classified as non-attainment for the Federal air quality standards. In the vicinity of the analysis area, only Aspen and Telluride are classified as non-attainment. Both are non-attainment for fine particulates (PM10).

Air Quality Monitoring

In addition to the monitoring of the six criteria pollutants discussed above, several other air quality related values are being monitored in the vicinity of the analysis area. They include acid precipitation, lake chemistry, and visibility. Monitoring sites are displayed on Figure III-30.

Acid Deposition: The National Atmospheric Deposition Program (NADP) sites monitor wet deposition (acid rain, snow, and fog). The majority of the deposited acids are nitric and sulfuric, formed by the mixing of nitrogen oxides and sulfates. Coal-fired power plants and motor vehicles are the major sources of acid pollutants in Colorado (Colorado Air Quality Data Report, 1991). NADP monitoring sites within 50 kilometers of the analysis area include: Molas Pass, Engineer Mountain Guard Station, Sunlight Peak, and Four Mile Park.

Lake Chemistry: Lake chemistry is monitored by university researchers at the Rocky Mountain Biological Laboratory in Gothic and by the Forest. The Forest has sampled the pH and Acid Neutralizing Capability at 35 lakes on the Forest and is in the process of developing a long-term monitoring program.

Visibility: Visibility is monitored at three sites in the vicinity of the analysis area. Sites are currently located at Molas Pass, Lake Irwin, and at Black Canyon of the Gunnison National Monument.

The Forest Service installed a visibility monitoring camera at Lake Irwin just east of Kebler Pass in 1992. It monitors visibility over the West Elk Wilderness.

The National Park Service monitors visibility at the Black Canyon of the Gunnison National Monument. The camera is aimed at Grand Mesa.

Visibility in the Weminuche Wilderness is monitored at Molas Pass on the San Juan National Forest.

Environmental Factor: Water

Surface Water

Streams, lakes, springs and wetlands provide water for beneficial uses both on the Forest and downstream. Water is important in supporting riparian communities; providing habitat for fish and wildlife; domestic water sources; recreational opportunities; power generation and salinity reduction. Historically, agriculture has been the primary industry on the west slope, and it continues to be very important. Water flowing from the Forest has been used for irrigation for over 100 years. Water resources have been intensively and extensively developed for the purpose of meeting irrigation needs. Most of the streams are classified by the State, and carry standards for recreation and cold water aquatic communities. A few are classified by the State for domestic use.

The entire analysis area lies within the Colorado River Basin, with the majority being part of the Gunnision River drainage. The character of the water resources does vary within the analysis area.

The analysis area can be broken up into three areas with similar water resource features: the Grand Mesa, North Fork of the Gunnison, the Uncompahgre Plateau.

The Grand Mesa is a large flat top mountain covered with numerous lakes and wetlands that were created by glaciation. Water resources have been intensively developed on the Mesa over the last 100 years, in order to meet irrigation needs in the valleys. Most of the lakes have been enlarged using earthen dams. A network of ditches and pipelines criss-cross the Mesa, moving water from one lake and watershed, to another. Streams are not that common on the Mesa top, due to its nearly flat topography. The flanks of the Mesa fall away steeply to the lower valleys, and have well defined drainages. The major streams flowing off the Mesa include; Surface Creek, Leroux Creek, Buzzard Creek, Leon Creek, Big Creek, Cottonwood Creek, Bull Creek, Coon Creek, and Kannah Creek. Natural streamflows have been altered to varying degrees because of diversions and reservoir regulation.

The North Fork of the Gunnison originates on the Forest, within the analysis area. Unlike the Grand Mesa, it is more typical mountain topography with a well developed drainage network, separated by steep slopes and ridges. Natural lakes are not common and are limited to high elevation cirque basins. Several irrigation reservoirs exist on the Forest, within the analysis area, with Overland Reservoir being the most significant. Several large ditches intercept streamflows in the upper third of the watersheds and transport water to either Overland Reservoir or off the Forest. Major streams in this area are: Terror Creek, Hubbard Creek, West Muddy Creek, East Muddy Creek, Anthracite Creek and Coal Creek. Seeps and springs are common along contact zones of different geologic formations. These saturated zones, along with unstable slopes, have resulted in numerous slumps and landslides.

The Uncompahgre Plateau area also includes the area to the north and east of Lone Cone Peak and the Naturita Division. It is the driest portion of the analysis area and consequently has no lakes and only small streams, many of which are intermittent. Some diversions exist on Forest, but are mostly small. An exception is the Gurley Ditch that captures a good portion of the water flowing in the headwaters of Beaver Creek. The streams flow off the Plateau to either the west or east and typically lie in deep canyons, separated by mesas. Major streams draining off the Plateau and Naturita Divison are: Tabeguache Creek, Horsefly Creek, McKenzie Creek, Spring Creek, Roubideau Creek, Naturita Creek and Beaver Creek.

Groundwater

Early reports of the groundwater resources in the upper Colorado River region estimated that there may be as much as 115 million acre feet of recoverable groundwater in the upper 100 feet of saturated rocks, although up to 70% may be saline (Price, 1974). It was further estimated that only 2% of the water consumed in the region is groundwater. Most of the groundwater development that does occur is in the lower populated valleys. Wells are generally in the alluvium and less than 200 feet deep. There is comparatively very little development and use of groundwater within or immediately adjacent to the Forest. Almost all use in close proximity to the Forest, is for limited domestic and/or livestock purposes. Most of these wells are also shallow (less than 200') in depth.

For the purposes of this groundwater discussion, the analysis area is broken into three hydrogeologic areas. More specific descriptions about each area follow. Summary tables of the major rock and hydrogeologic units and the principal aquifers are presented for each area. In all areas the alluvium generally provides a better aquifer than the bedrock, due to its higher water yields and better water quality. There are scattered occurrences of wells tapping bedrock aquifers other than the principal aquifer where local conditions and isolated secondary fracturing create favorable conditions.

TABLE III-3. GEOLOGIC UNITS AND HYDROGEOLOGIC CHARACTER SOUTHERN UNCOMPAHGRE VALLEY AND SAN MIGUEL RIVER BASIN

GEOLOGIC AGE	ROCK UNIT	MAXIMUM THICKNESS (FT.)	LITHOLOGY	WATER BEARING PROPERTIES
QUATERNARY	Alluvium, Colluvium, Landslide, Glacial Drift, Eolian Deposits	200 (?)	Silt, Sand, Gravel	Expect dissolved solid concentrations less than 1000 mg/l with most wells less than 400 mg/l. Most yields between 8-25 gpm.
TERTIARY	Volcanic Rock		Tuffs, Acidic Andesites, Rhyolites	Confining beds.
CRETACEOUS	Mesa Verde Group	1100	Sandstone, shale, coal	
	Mancos Shale	2950	Carbonaceous Marine Shale	
	Dakota Sandstone, Burro Canyon Formation	200	Interbedded Sandstone, Shale, Coal	Yields range from 1-216 gpm. Most wells yield less than 10 gpm.
JURASSIC	Morrison Formation	850	Shale, Sandstone, Conglomerate	Yields from 3 wells ranged 0-130 gpm.
	San Rafael Group	410	Siltstone, Sandstone	Possible aquifers, but no data.
	Glen Canyon Group	640	Sandstone, Siltstone	
TRIASSIC	Chinle Formation	590	Siltstone	Confining Beds
	Moenkopi Formation	295	Siltstone	
PERMIAN	Cutler Formation & Rico Formation	10,700	Sandstone, Siltstone, Shale	
PENNSYL-VANIAN	Hermosa Formation	7,500	Limestone, Shale, Thick Beds of Evaporites in Middle Paradox Member	
	Molas Formation	100	Shale, Limestone	
MISSISSIPPIAN	Leadville Limestone	400	Limestone, Dolomite	Possible aquifers, but no data. Depth and potential quality generally preclude use.
DEVONIAN	Ouray Limestone	160	Dolomitic Limestone	
	Elbert Formation	180	Dolomite, Limestone, Sandstone	

(After Ackerman & Rush, 1984)

Southern Uncompahgre Valley and San Miguel River Basin: Table III-3 gives a brief overview of the major rock and hydrogeologic units in this area. The principal aquifers in the area are the alluvium and the Dakota Sandstone. The lower sandstone of the Dakota generally yields greater amounts than the upper sandstone. For water wells in the alluvium, yields range between 1 1/2 - 25 gallons per minute (gpm) and total dissolved solids concentrations are usually less than 400 milligrams per liter (mg/l). For water wells in the bedrock aquifers, yields range from 0 - 216 gpm and average less than 10 gpm. Total dissolved solid concentrations are usually greater than 400 mg/l in the bedrock aquifers.

All major rock units abut or dip away from the Uncompahgre Plateau highland. General groundwater flow follows the dip towards the Uncompahgre River and San Miguel River valleys. Recharge into the aquifers occurs on the Uncompahgre Plateau from percolation of water into the outcrops. Tributary valleys such as Spring Creek reduce the net effect of the recharge by draining the

dissected formations through springs. To the east of the Plateau, the major valleys at the base and parallel to the Plateau have eroded through the Dakota. Consequently recharge of the Dakota at the lower elevations occurs where alluvium and irrigation canals are in contact with the formation.

TABLE III-4. GEOLOGIC UNITS AND HYDROGEOLOGIC CHARACTER GRAND MESA AREA

GEOLOGIC AGE	ROCK UNIT	MAXIMUM THICKNESS (FT.)	LITHOLOGY	WATER BEARING PROPERTIES
QUATERNARY	Alluvium, Colluvium, Landslide, Glacial Drift	100 ?	Silt, Sand, Gravel	Dissolved solid concentrations range from 63-2970 mg/l. Yields range between 2-1000 gpm and average about 20 gpm.
TERTIARY	Extrusive Volcanics	200	Basalt	Aquitard
	Uintah Formation, Green River Formation	1000	Siltstone, Sandstone, Marlstone	No data. Yields of 1-5 gpm may be expected from sandstone.
	Wasatch Formation	3400	Claystone, Siltstone, Sandstone, Lignite, Conglomerate	Limited data indicates possible yields of 25 gpm from sandstone and conglomerate.
CRETACEOUS	Mesa Verde Group	3000	Sandstone, Shale, Coal	Yields are generally less than 10 gpm and range from 1-24 gpm. dissolved solid concentrations range from 206-3360 mg/l and average 880 mg/l.
	Mancos Shale	4500	Carbonaceous Marine Shale	Generally a confining bed. Some water in fractures, but quality mostly unsuitable with dissolved solid concentrations up to 8200 mg/l.
	Dakota Sandstone, Burro Canyon Formation	350	Sandstone, Shale, Conglomerate, Coal	Yields range from 5-26 gpm. Dissolved solid concentrations range from 56-3200 mg/l.
JURASSIC	Morrison Formation	580	Mudstone, Sandstone	No data.

(After Ackerman & Brooks, 1986)

Grand Mesa: Table III-4 gives a brief overview of the major rock and hydrogeologic units in this area. The principle aquifers in the area are the alluvium, the Mesa Verde Formation, the Dakota Sandstone and the Burro Canyon Formation. The Dakota Sandstone and Burro Canyon Formation are generally considered a single hydrogeologic unit. The well yields and water quality are highly variable within the area. The range of available information is presented in the accompanying table. Reports of some water samples showed concentrations of dissolved solids, sulphate, chloride, fluoride, iron, manganese and selenium that exceeded EPA drinking water standards (Ackerman, 1986).

The recharge area of the Mesa Verde Group occurs along outcrops in the North Fork of the Gunnison River valley. In general, the steep terrain limits infiltration. The Rollins Sandstone Member at the base of the Mesa Verde, could conduct water, but its near vertical exposures inhibit recharge. Groundwater flow is generally northward and down dip. To the east of Grand Mesa, in the Crystal River drainage near Redstone, there is reportedly some recharge into the Maroon Formation (Brogden, 1976). These rocks are steeply dipping to the west and southwest, and groundwater flow would be in the same direction. However, no specific groundwater information was found or reported for the Maroon

Formation, in the study area. The alluvium aquifers locally recharge and discharge. Where alluvial aquifers are in contact with bedrock aquifers they are probably hydraulically connected and some intermixing of the two aquifers can be expected.

TABLE III-5. GEOLOGIC UNITS AND HYDROGEOLOGIC CHARACTER CRESTED BUTTE AREA

GEOLOGIC AGE	ROCK UNIT	MAXIMUM THICKNESS (FT.)	LITHOLOGY	WATER BEARING PROPERTIES
QUATERNARY	Alluvium, Colluvium, Landslide, Glacial Drift	140 ?	Silt, Sand, Gravel	Yields range from 2-100 gpm and average 20 gpm.
TERTIARY	Intrusive and Extrusive Volcanics	-	Basalt, Breccia, Tuffs, Granodiorites, Quartz Monzonite, Granite	May be confining layer, but yields of 20 gpm occur from locally fractured basalts and tuffs.
	Wasatch Formation	2200	Sandstone, Shale, Conglomerate	
CRETACEOUS	Mesa Verde Group	2300	Sandstone, Carbonaceous Shale, Coal	Data for 1 well - 9 gpm.
	Mancos Shale	5000	Carbonaceous Marine Shale	Yields range from 1-5 gpm.
	Dakota Sandstone, Burro Canyon Formation	300	Sandstone, Shale, Conglomerate, Coal	Yields range from 5-60 gpm.
JURASSIC	Morrison Formation	400	Shale, Sandstone, Limestone	
	Junction Creek Sandstone	180		
	Entrada Sandstone	85	Sandstone	
PERMIAN	Maroon Formation	3500	Sandstone, Shale, Limestone, Conglomerate	Locally may be aquifers near outcrop areas. Yields are less than 15 gpm.
PENNSYL-VANIAN	Gothic Formation	1750		
	Beldon Formation	650		
MISSISSIPPIAN	Leadville Limestone	300	Limestone	
CAMBRIAN	Peerless Formation, Sawatch Quartzite	300	Quartzite	
PRECAMBRIAN	Crystalline Rocks	-	Granites, Granodiorite, Quartz, Monzonite, Gneiss	Locally yields from 1-3 gpm where fractured.

(After Giles, 1980)

Crested Butte: Table III-5 gives a brief overview of the major rock and hydrogeologic units in this area. The rock units of Jurassic and early Cretaceous age: the Entrada Sandstone, Junction Creek Sandstone, Morrison Formation, Burro Canyon Formation and Dakota Sandstone are grouped as a single hydrogeologic unit. This unit and the alluvium are the principal aquifers in the area. For water wells in the principal bedrock aquifers, yields range from 5 - 60 gpm and total dissolved solids concentrations range from 55 - 830 mg/l. For water wells in the alluvium, yields range from 2 - 100 gpm and average about 20 gpm. Reports of some water samples showed concentrations of fluoride and selenium that exceeded EPA drinking water standards (Giles, 1980).

The alluvial aquifers recharge and discharge locally. Recharge of the bedrock aquifers is generally at the outcrop and groundwater flow is down dip to the west and southwest. Confining conditions can be created where the Dakota and Entrada Sandstones are overlain by the Mancos Shale and Morrison Formation. Flowing wells are found in the Ohio Creek and Gunnison River valleys.

Environmental Factor: Water Quantity

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 (2.87 million acre feet/year). It is estimated that the analysis area is responsible for 20% of that figure (715,000 acre feet/year). Natural annual average water yields within the analysis area vary by precipitation zone and vegetation. They range as high as 17 inches to as low as 2.5 inches. In terms of the general areas discussed above (under Surface Water), the Grand Mesa typically produces 12 inches of runoff and the North Fork of the Gunnison and the Uncompahgre Plateau produce 9.5 and 6.5 inches, respectively.

Research has proven that water yields can be increased by manipulating vegetative cover, increasing surface runoff by reducing infiltration and management of the snowpack. Manipulation of vegetative cover, either through timber harvest or fire, is the element most influenced by National Forest activities. As with natural water production, water yield increases also varies with vegetation type. Aspen treatments have the highest increase potential at 31%, spruce-fir has 22% and aspen mixed conifer has 25%. Ponderosa pine, which is common on the Uncompahgre Plateau, is not considered in water yield increase calculations, because snowfall accumulations are generally low. Water yield increases are temporary, and recovery begins with the re-establishment of trees on the site. Past management activities across the analysis area are believed to have increased water production only about 1% or 7000 acre feet/year. This figure represents an average from year to year, recognizing that actual water yields can vary up or down, based upon the level of vegetative manipulation each year, where it is located and recovery of past disturbed sites.

Environmental Factor: Water Quality

Water quality on the Forest is principally a function of the geology the water flows over or through, the flow regime and surface management activities. While water on the Forest is generally of good quality it does vary across the analysis area. The two water quality parameters with recognized concern are sediment and salinity.

In reviewing the history of water quality monitoring on the Forest, the first period of record that could be found was 1970 to 1972. During that period streamflow, dissolved oxygen, temperature, pH, turbidity and bacteria data were collected. From 1979 to 1983, water quality data was collected on numerous Forest streams. Temperature, conductivity, pH, alkalinity, hardness, turbidity, suspended sediment, dissolved oxygen, and fecal coliform were the parameters collected. This data has been assembled into notebooks and is readily available. The data has not been analyzed to define baseline water quality character, but this may be done in the future. From 1983 to 1987, data was collected at five sites strategically located across the Forest, with the objective of characterizing water quality that could then be extrapolated across the Forest. The assessment of water quality in this document is a reflection of what was learned in these baseline studies.

Sediment is a water quality pollutant most associated with natural resource management activities. Erosion is a fundamentally physical process in the natural environment. Erosion rates vary by site, and are influenced by climate, vegetative cover, slope, geology and soil type. Accelerated erosion occurs when sites are physically disturbed by removing vegetation and exposing bare ground. Excavation of soil cover and concentration of water will increase erosion rates. Sedimentation is a result of transporting soil particles by water, wind or gravity to streamcourses, where it can adversely impact beneficial uses. Channel bed and bank erosion are also responsible for sediment increases.

Within the analysis area, the rocks are principally sedimentary. Water quality varies according to whether the parent materials consist of sandstones or shales. Sandstones generally weather to a coarser textured material than shales. The coarser the average particle size, the higher the percentage of sediment moved is bedload. The finer the particle size, the greater the suspended sediment. Turbidity is caused by very fine clay-size particles in suspension. This turbidity is most noticeable in streams that drain the Wasatch shale, such as Muddy Creek and Buzzard Creek. Those streams can become very discolored with only modest increases in streamflow. The Mancos Shale is exposed at lower elevations surrounding the Uncompahgre Plateau and along the southern and western flanks of the Grand Mesa. The streams in these areas can also become quite turbid during the spring, but do not carry the extreme silt loads common in streams draining areas underlain by the Wasatch shale.

The higher elevations on the Uncompahgre Plateau and Grand Mesa are underlain by sandstone and basalt, respectively, which are much more resistant than shale. In many instances, sediment derived from these materials has been transported down channel and make up much of the channel bed, even in the zones dominated by shale.

Conductivity and Total Dissolved Solids vary inversely to streamflow. These two parameters are good indicators of salinity, which is a recognized problem in areas of Mancos Shale. During high flows when surface runoff is the principal contributor to streamflow, conductivity ranges from 60 to 160 micromhos. During base flow conditions when groundwater is a significant contributor to streamflow, conductivity is considerably higher, ranging from 360 to 420 micromhos. Surface water is hard (high calcium carbonate) and slightly alkaline, within the analysis area. The hardness and alkalinity is even more pronounced at low flows because of groundwater contributions. Trace metals found in waters on the Forest include aluminum, barium, cadmium, copper, manganese, molybdenum, nickel, lead, and zinc. The concentrations of these metals are well within State standards. The exception to this is in areas of sulfide mineralization outside the analysis area, where acid rock drainage has resulted in pH's low enough to put significant concentrations of metals into solution.

Water temperatures vary over the season, with minimum temperatures approaching 0° C. during the winter, and 15 to 17° C. at lower elevations on the Forest, during August and early September.

Lakes and reservoirs make up a sizable portion of the surface water resource on the Forest. The quality of these water sources is generally very good. One noteworthy difference between streams and waterbodies is the potential for contamination of waterbodies by livestock. Livestock, particularly cattle, typically concentrate around water during the hot season; due to the availability of water, shade, and more palatable forage. High nutrient and bacteria levels have been documented at several reservoirs on the Grand Mesa. High nutrient loads, produce an increase in algae and aquatic plants. During the winter, decomposition of plant material reduces the levels of dissolved oxygen, which if low enough, results in fish mortality.

Environmental Factor: Range

Livestock Grazing

Livestock grazing is a significant use on the public land potentially affected by oil and gas exploration and development, in the analysis area. Ranchers, who graze livestock under conditions specified in a grazing permit, depend on the forage produced on the National Forests to supply 20 to 30 percent of their annual forage needs.

Grazing normally occurs under a grazing management system designed to perpetuate and sustain plant growth, and achieve land management objectives prescribed in the Forest Plan and Allotment Management Plans. Such prescriptive use incorporates specific direction for grazing on a certain parcel of land called a "grazing allotment". Direction varies significantly, dependent upon class of livestock, slope, water, management objectives, and the condition of the soil and vegetative resource.

Within the analysis area there are 69 cattle allotments and 16 sheep allotments, which are typically grazed from June 1 to October 15, each year. This includes approximately 102,000 cattle and 17,000 sheep.

Environmental Factor: Roads

The detailed maps included with this FEIS show most of the State Highways, arterial roads and collector roads discussed below.

State Highways

Two State highways pass through the analysis area: State Highways (SH) 65 and 133. SH 65 crosses the Grand Mesa National Forest providing access to much of the Grand Mesa. SH 133 passes through a small portion of the analysis area, at McClure Pass.

In addition, there are several other Federal and State highways that are not within the planning area, but provide access to it. They are:

- US 50 connecting Grand Junction, Delta, and Montrose, providing access to the west end of Grand Mesa and the Uncompahgre Plateau, from the east side.
- SH 330 linking the town of Collbran with SH 65, providing access to the Muddy Basin country and Grand Mesa, from the north.
- SH 141 running west from Whitewater, through Unaweep Canyon and the town of Naturita, providing access to the Uncompahgre Plateau, from the west side.
- SH 145 extending from Telluride through Norwood, providing access to the south end of the Uncompahgre Plateau and the area south of Norwood.
- SH 92 beginning in Delta and passing through Hotchkiss and Crawford, providing access to portions of Grand Mesa and the area west of the West Elk Wilderness.

Arterial Roads

Arterial roads are Forest Development Roads (FDR) that provide access to major areas of the forest. All of the Forest's arterial system is in place. The only work taking place on these roads is minor reconstruction and maintenance activities, including correcting drainage and surfacing.

The Forest's arterial system is used for all forms of recreation activities, as well as commercial activities such as timber haul and minerals exploration and development. It is estimated that 95% of the traffic on these roads is recreational and 5% is commercial traffic. All of these roads receive seasonal use, from early summer to late fall. The average daily traffic (ADT) volumes for these roads vary from approximately 50 vehicles per day to a high of 300 vehicles per day.

There are approximately 358 miles of arterial road leading into or within the analysis area: 38 miles are paved, 253 miles have an aggregate surface, and 67 miles have a native soil surface.

TABLE III-6. ARTERIAL ROADS WITHIN ANALYSIS AREA			
ROAD NUMBER	ROAD NAME	MAINT. LEVEL*	NUMBER OF LANES
12	Kebler Pass	4	2
90	Old Highway 90	4	2/1
100	Lands End	5/4	2/1
121	Trickle Park	5/4	2
123	Old Grand Mesa	4/3/2	2
128	Leroux Creek	5/3	2/1
265	Buzzard Divide	4	1
270	Silt	4	2
402	Divide	4	1
503	Delta-Nucla	4	1
510	Dave Wood	4	2/1
530	Sanborn Park	4	1
607	Hamilton	3	1
608	McKee Draw	3	1
610	Dolores to Norwood	5/4	2
611	Beaver Park	4	1
618	Fall Creek	4	1
701	Stevens Gulch	5/4	2/1

Note: Where more than one lane or road width is shown, the road standard changes along it's length.
* Maintenance levels described in Appendix J.

Collector Roads

The collector road system consists of Forest Development Roads that generally take off of the arterial system and provide access to smaller areas, such as individual drainages. Nearly all of the collector road system is in place, with only a few new miles of road being built each year; mostly for special purpose activities, such as timber sales. The current Five-year Timber Sale Action Plan shows 7.8 miles of new collector road to be constructed over the next five years.

There are 290 miles of collector road within the analysis area: 2.5 miles are paved, 93 miles have an aggregate surface and 194 miles have a native surface. All of these roads are single lane with turnouts.

The Forest's collector system has similar use patterns as the arterial road system. Collector roads are used for all forms of recreational activities, as well as commercial activities such as timber haul and minerals exploration and development. It is estimated that 90% of the traffic on these roads is recreational, and 10% is commercial traffic. All of these roads receive seasonal use, only opening up in early summer and being closed out by snow in late fall. The average daily traffic volumes for these roads vary from approximately 10 vehicles per day to a high of 100 vehicles per day.

TABLE III-7. COLLECTOR ROADS IN ANALYSIS AREA

ROAD NUMBER	ROAD NAME	MAINT. LEVEL*	NUMBER OF LANES
105	Anderson Reservoirs	2	1
109	Flowing Park	3	1
110	Pipeline	2	1
112	Doughspoon	2	1
116	Island Lake	4	1
125	Surface Creek	3	1
126	Weir & Johnson	4	1
127	Leon Lake	2	1
128	Leroux Creek	3	1
129	Hay Park	4	2
257	Cottonwood Lakes	4	1
260	Lambert	3	1
262	Park Creek	2	1
263	Willow	2	1
266	Porter Flat	2	1
268	Owens Creek	3	1
275	Kimball	2	1
403	Big Creek	3	1
508	Transfer	3	1

TABLE III-7. COLLECTOR ROADS IN ANALYSIS AREA			
ROAD NUMBER	ROAD NAME	MAINT. LEVEL*	NUMBER OF LANES
510	Dave Wood	4	2
512	Hanks Valley	2	1
513	Craig Point	3	1
516	Good Enough	3	1
521	Sanborn School	3	1
537	Horsefly	3	1
602	Copper King	3	1
603	Houser	3	1
609	Naturita	3	1
615	West Beaver	3/2	1
618	Fall Creek	3	1
619	Specie Creek	3	1
631	Mid Beaver	2	1
703	Shoneman Park	2	1
704	Hubbard Canyon	3	1
705	Overland Reservoir	3	1
706	Lost Lake	4	1
710	Minnesota Creek	3	1
711	Dry Fork	2	1
798	Lone Cabin	2	1
844	Piute	3	1

Note: Where more than one lane or road width is shown, the road standard changes along it's length.
* Maintenance levels described in Appendix J.

Local Roads

Local roads are generally short spur roads that take off from the arterial and collector roads, generally providing access for a single purpose, such as campgrounds, fishing sites, trail heads, timber

cutting units, and oil and gas drill sites. Local roads are almost always single lane roads, with few exceptions, such as two-lane roads in campgrounds.

There are approximately 827 miles of local roads in the analysis area most of which have a native surface. Many of these local roads have been gated and closed after the term of their intended use.

Local roads are currently being constructed within the analysis area for timber access. The current Five-year Timber Sale Action Plan shows an average of 25 miles of local road will be constructed within the analysis area, each year, for the next five years. Most of these roads will be closed for resource protection once the timber has been removed.

Travel Management

The Travel Management Plan delineates roads and trails that are open, closed or restricted either seasonally or by motorized vehicle type. Wilderness areas, Research Natural Areas, and special interest areas are closed to all motorized vehicles. Major arterial and collector roads are usually open, with the exceptions of seasonal or wet weather closures to protect the road investment and reduce resource damage such as erosion and siltation. Where roads are within restricted travel management areas, they remain open for access to private land or multiple-use activities. These activities can include oil and gas activities, logging, firewood access, reservoir administration and hunter access. Roads may be closed in a restricted area to further enhance wildlife seclusion, prevent unacceptable resource damage, avoid high hazard locations, or to reduce maintenance costs. All single purpose, newly constructed, local roads are closed. Roads in open areas may be either open or closed based on the same criteria used above for roads within restricted areas. Additional considerations to those criteria are:

1. Four-wheel drive recreation roads that are designated in the Forest transportation inventory should remain open.

2. Roads should usually remain open within areas that have the following management emphasis:
- Semi-primitive Motorized recreation.
- Roaded Natural recreation.
- Wildlife habitat management, but with a Semi-primitive Motorized recreation opportunity.

3. Seasonal closures are used where resource damage or road investment may be mitigated with such a closure.

Roads and trails are open, closed or restricted, based on management goals of the area through which they pass, the land's characteristics, and the prevention of unacceptable resource damage. Additional closures may occur due to insufficient maintenance funds.

Environmental Factor: Visual Resource / Scenery

The analysis area contains a great variety of landscapes, which accounts for it's high visual resource value. Natural features include: high mountain peaks, mesa tops, deep canyons, distinctive gorges, lakes, streams, a variety of forest types, meadows, fall aspen color, and wildlife.

These landscapes are grouped into six areas of land with similar landform, vegetation and soil characteristics. These six areas are called landscape character sub-types and are used as a frame of reference in classifying the physical features of an area into visual variety classes. The six landscape character sub-types are:

Collbran Valley Brushlands
Uncompahgre Plateau Pinyon Juniper Lands

San Juan Range Forestlands
Uncompahgre Plateau Forestlands
West Elk Range Forestlands
Grand Mesa Forestlands

These landscapes are visible from many viewer locations which include highways, roads, trails, developed recreation sites, lakes and rivers, mountain tops, ridges, and communities. The most sensitive viewer locations in the analysis area are:

State Highways 65, 90, 133, 141, and 145
Gunnison County Road 12 (Kebler Pass Road)
FDR 100 (Lands End Road)
FDR 121 (Trickle Park Road)
FDR 503 (Delta/Nucla Road)
Crag Crest National Recreation Trail
Crag Crest National Recreation Ski Trail
Mesa Lakes Recreation Facilities Complex
Island/Ward Lakes Recreation Facilities Complex
Alexander Resort
Powderhorn Ski Area Resort

In 1977, the Forest Service developed a visual management system to identify and manage the visual resource and protect it's values. The result of this system was a set of Visual Quality Objectives (VQO) based on characteristic landscape, the physical features of the land, people's concern for scenic quality and the opportunity of people to see the land. The Visual Quality Objectives for the analysis area are listed in the following table:

TABLE III-8. VISUAL QUALITY OBJECTIVES IN ANALYSIS AREA

VQO	PERCENT OF ANALYSIS AREA	PERCENT OF FOREST
Preservation	0	15
Retention	4	6
Partial Retention	17	19
Modification	72	56
Maximum Modification	7	4

In the visual management system the development of VQO's is the first step. The second step is to identify the relative difficulty of achieving the VQO's on the ground. This is done by identifying the capability of the landscape to absorb visual impacts. The result of this inventory is a set of visual absorption capability (VAC) based on biological and physical factors, observer related factors, and the existing visual condition. The VAC for the analysis area is made up of the following percentages:

High - 41%
Moderate - 33%
Low - 26%

The Forest Service Manual, 2311.11 Exhibit 1, displays the ranges of VQO that correspond to adopted Recreation Opportunity Spectrum (ROS) Classes. The Forest ROS class inventory is a baseline 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 at the project level.

Environmental Factor: Recreation Opportunities

Outdoor recreation is an important contributor to economies in the vicinity of the analysis area. The Forest ranks in the top 25% of all National Forests in recreation use. The analysis area includes approximately 1/3 of the Forest and 1/3 of its recreational use. It provides for a wide range of recreational activities. We expect this demand for recreation opportunities to continue to increase. The popularity of recreation activities on the analysis area for 1990, is summarized below.

TABLE III-9. RECREATION USE BY ACTIVITY, 1990

ACTIVITY GROUPING	TOTAL FOREST RVD's* (thousands)	ANALYSIS AREA RVD's (thousands)
Camping, Picnicking and Swimming	550.9	139.2
Mechanized Travel and Viewing Scenery	1,023.8	324.1
Hiking, Horseback Riding and Water Travel	341.5	84.5
Winter Sports	614.9	77.8
Resorts, Cabins and Organization Camps	140.6	109.8
Hunting	604.6	302.4
Fishing	261.2	177.1
Nonconsumptive Fish and Wildlife Use	14.8	9.4
Other Recreation Activities	157.2	84.2
Grand Total	3,709.5	1,308.5

* RVD = Recreation Visitor Day, 12 hour period

Developed Recreation

Existing developed recreation sites in the analysis area include: 2 visitor centers, 2 interpretive sites, 20 family campgrounds, 4 picnic grounds, 2 organizational camps, 3 privately owned lodges/resorts, 47 privately owned recreation residences and 1 privately owned resort ski area. These developed recreation sites have a capacity of approximately 4500 people at one time (PAOT), with 1800 PAOT's being accommodated in the 20 family campgrounds and 1800 skiers at one time (SAOT) being accommodated at Powderhorn Ski Area. No State of Colorado recreation area or County recreation areas are located within the analysis area. Five State of Colorado recreation areas are located adjacent to the area (Vega Reservoir, Ridgway Reservoir, Paonia Reservoir, Crawford Reservoir, and Miramonte Reservoir). Two National Park Service areas (Black Canyon National Monument, Curecanti National

Recreation Area) are adjacent to the analysis area, and the Colorado National Monument is nearby. (Figure III-28) It is estimated that 85% of the developed use in the analysis area occurs on Grand Mesa.

Dispersed Recreation

Dispersed recreation activities account for an estimated 75% of all recreation use in the analysis area.

The leading dispersed recreation activity is automobile travel for scenic enjoyment, which is about 25% of the total. The high incidence of this activity can be attributed to the exceptional scenery along travel routes. Hunting and fishing are the next two most popular activities, followed by camping.

There are over 600 miles of trails, in a variety of settings available to non-motorized and motorized users. The Crag Crest trail and Crag Crest ski trail (County Line ski trail) are two National Recreation Trails in the analysis area. The proposed Dominguez - Escalante National Historic Trail crosses the analysis area on the south end of the Uncompahgre Plateau and through the Hubbard Creek and Buzzard Divide area of the Forest. This route was designated by Congress for study as a National Historic Trail. A Draft EIS was prepared by the National Park Service. The Forest Service recommended "high potential segments" be identified a National Historic Trail and location criteria be developed. A Final EIS has been completed and submitted to the Environmental Protection Agency. The administration recommends that no Federal action be taken at this time, due to the general lack of public support for the trail and the present national budgetary constraints. The proposed route for the American Discovery Trail crosses the Grand Mesa. In October 1992, a law was passed mandating a study of the American Discovery Trail, to determine it's suitability for inclusion in the National Trails System. The National Park Service has three years to complete the study. On it's route from California to Delaware, the trail passes through the analysis area. The trail will cross Grand Mesa following the Kannah Creek Trail, the Crag Crest National Recreation Trail, and the Sunlight-Powderhorn Snowmobile Trail. At this time the Charter for the trail has not been finalized, i.e., how much protection from development will the trail receive.

There are over 1,500 miles of roads with approximately 425 miles classified as graded or paved. Off-highway vehicle (OHV) use in the analysis area is estimated to be 5% of the total recreation use.

State Highway 65 over Grand Mesa, State Highway 133 and County Road 12 over McClure Pass and Kebler Pass (the West Elk Loop), respectively, and State Highway 145 across the southwest corner of the Uncompahgre Plateau are designated Colorado Scenic Byways. The former two are proposed as National Forest Scenic Byways. Beautiful fall colors of aspen and oakbrush reward those who drive Forest roads during the fall. Several areas are noted Statewide and are visited annually by those seeking viewing and photographic opportunities.

Recreation Opportunity Spectrum (ROS)

Forest Service recreation planners use the Recreation Opportunity Spectrum (ROS) as described in the ROS Users Guide. ROS provides a framework for defining or describing different classes of outdoor recreation environments, activities, and experiences possible on the Forest. ROS classes include Primitive (P), Semi-primitive Non-motorized (SPNM), Semi-primitive Motorized (SPM), Roaded Natural (RN), Roaded Modified (RM), Rural (R), and Urban (U). The ROS Class composition is summarized in table III-10.

Areas which are managed under the different ROS classes can absorb only as much impact from oil and gas exploration and development or 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 non-motorized cross country travel. Because the Visual Quality Objective is Retention, all management activities must not be noticeable to the casual forest visitor.

In Semi-primitive Non-motorized areas, 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, Roaded Modified, 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 line, form, color and texture created must blend with the surrounding landscape character.

The ROS class may change as a result of activities within an area.

TABLE III-10. ANALYSIS AREA ROS CLASS COMPOSITION

ROS CLASS	PERCENT (%) OF ANALYSIS AREA
Urban (U)	0
Rural (R)	1
Roaded Natural (RN)	22
Roaded Modified (RM) [subclass of RN]	4
Semi-primitive Motorized (SPM)	47
Semi-primitive Non-motorized (SPNM)	24
Primitive (P)	2

Wild and Scenic Rivers

Two rivers on the Forest were listed as potential Wild and Scenic rivers by the Heritage Conservation and Recreation Service (now the National Park Service) in its nationwide rivers inventory. These two rivers are not in the analysis area.

Wilderness

Three (3) Wilderness areas are adjacent to the analysis area. They are: 1) Raggeds Wilderness, 2) West Elk Wilderness and 3) Lizard Head Wilderness. BLM Wilderness Study Areas adjacent to the analysis area include the Tabeguache Creek, Camel Back and Adobe Badlands. No Wilderness areas, Wilderness Study Areas or Further Planning Areas for Wilderness exist in the analysis area.

Environmental Factor: Cultural and Historical Resources

There are cultural (prehistoric and historic) as well as natural resources on the Forest. In most cases, the location is kept confidential to protect these resources from vandalism, and to preserve them for scientific and educational purposes. The Forest's complete historic overview is in three volumes, prepared jointly by the BLM and Forest Service. Work is proceeding on the prehistoric overview. Until the prehistoric overview is finished, data will be adapted from the completed BLM prehistoric overview of the surrounding areas.

The USDA Forest Service has developed a policy (FSM 2361.04) of performing cultural surveys on all areas of proposed ground disturbing activities before such activities commence, in order to comply with 36 CFR 800, EO 11593, and the National Historic Preservation Act of 1966, as amended. The main objective of these inventories is to locate and assess cultural resources in identified project areas, with regards to the National Register of Historic Places. The located resources also have interpretive and educational opportunities values that illustrate important aspects of American cultural heritage.

As of June 1991, approximately 500,717 acres of the Forest have been surveyed for cultural resources (approximately 17%). Within the Forest boundary, approximately 98 eligible and 328 potentially eligible sites to the National Register of Historic Places have been identified. Numerous significant cultural resources, covering roughly the last 10,000 years of human history, and one of the most significant paleontological resources in North America, dating back to about 150,000,000 years ago, have been located. Currently, however, no sites on the forest have official National Register status; but one historic and four prehistoric National Register Archaeological Districts have been proposed.

The following summary lists the categories of significant and potentially significant cultural and paleontological resources that are located within the study area.

Prehistoric Resources

Prehistoric aboriginal groups have apparently occupied West Central Colorado since the early Holocene (10,000 B.P.). The period of occupation can be subdivided into several stages based on variation through time in the material culture and postulated lifeway of the prehistoric inhabitants. The major chronologic subdivisions are as follows: Paleo-Indian (8,000-5,500 B.C.); Archaic (5,500 B.C.- 450 A.D.); Formative (1-1,200 A.D.); Protohistoric/Historic Aboriginal (1,200-1,880 A.D.). Evidence of Paleo-Indian occupation is sparse and mostly restricted to areas outside the analysis area, around present day Montrose, Colorado. The evidence of Archaic and Formative occupations of the area is abundant and found throughout the analysis area.

Several types of Prehistoric sites have been identified in the analysis area. Many of the sites can fall into more than one type. Types of sites that can be encountered in the analysis area: (1) Lithic/Tool Scatters, (2) Lithic Quarrying Locations, (3) Rockshelters, (4) Wickiups and Wickiup Villages, (5) Circular Dry-laid Masonry Structures and Villages, (6) Small Adobe Pueblos, and (7) Scarred Trees.

Cultural resources have been located throughout the analysis area. They have been encountered at any elevation and in almost all environmental contexts. Most often they have been found in open or semi-open meadow contexts. Postulated campsites are frequently encountered on generally flat benches, mesas, and ridges in close proximity to water and lithic resources. Lithic/tool scatters are by far the most frequently encountered resource type on the forests. The scatters can range in composition from just a few flakes to 1,000's of flakes and numerous formal tools. They range in size from less than an acre to several hundred acres. Lithic scatters are generally classified as limited activity areas, short term camps and habitation sites.

Significant and potentially significant prehistoric archaeological resources located in the analysis area are presented below.

Proposed Englehart Park Archaeological District: The district is 664 acres of the NFS land on the Grand Mesa. It contains nine prehistoric sites and twenty-six isolated finds. It has been nominated to the National Register of Historic Places. The Forest's recommendation is that it be protected by avoidance until it can be studied and interpreted.

Proposed Sheep Flats/Grove Creek Archaeological Districts: Two potential districts have been proposed in the Sheep Flats area of the Grand Mesa. The north district contains eleven resources and covers 248 acres, and the south district contains six resources and covers 89 acres. The Forest's recommendation is that these districts be protected by avoidance until they can be studied and interpreted.

Proposed Horsefly Creek Burn Archaeological Districts: Two potential districts have been proposed along Horsefly Creek on the Uncompahgre Plateau. The Albin Draw District contains five prehistoric sites and covers 89 acres. The Logging Camp Draw District contains four large prehistoric sites and covers 259 acres. The Forest's recommendation is that these districts be protected by avoidance until they can be studied and interpreted.

Proposed Patterson Mountain Archaeological District: This district is located on Patterson Mountain on the Uncompahgre Plateau. It includes twenty-one sites clustered together and covers 335 acres. The Forest's recommendation is that it be protected by avoidance until it can be studied and interpreted.

Historic Resources

The historic period for the analysis area can be broken down into several overlapping chronologic themes. These are: (1) Spanish Exploration (1750-1776), (2) Fur Trading (1775-1850), (3) Government Exploration (1845-1870), (4) Contact and Ute Removal (1850-1881), (5) Mining (1860-1880), (6) Transportation (1882-1891), (7) Urbanization (1881-1900), (8) Farming and Stock Raising (1878-Present), (9) Federal Activity (1892-Present), (10) The Depression and CCC Activities (1930-1941), (11) New Mining and Energy Exploration (1900-1950), (12) Recreation and Tourism (1892-Present).

The historic period on the Forest began in 1750 when the first contact was made between aboriginal inhabitants and the Spanish, with the signing of the Spanish and Indian Treaty. Don Juan Rivera crossed the south end of the Uncompahgre Plateau at least once, and possibly three times between 1761 and 1765. He is known to have traveled as far as the confluence of the Uncompahgre and Gunnison Rivers at present day Delta, Colorado, before returning to New Mexico. In 1775, three of Rivera's companions on the expedition traveled and traded down the Gunnison River as far as its confluence with the Colorado River, at present day Grand Junction, Colorado.

The Spanish friars Dominguez and Escalante followed Rivera's route to the San Miguel River, in search of a route to Monterey, California, in 1776. They are believed to have crossed the south end of the Uncompahgre Plateau through Horsefly Canyon. They were then guided by the Utes up the North Fork Valley and Hubbard Creek and into Hubbard Park and the West Muddy Pass area on the east end of the Grand Mesa.

In the early 1800's, European fur trappers and traders incurred into the area. Antoine Robidoux established Fort Uncompahgre at the confluence of the Uncompahgre and Gunnison Rivers, near present day Delta, Colorado, to trade with the Utes in the area. No remains exist of the fort today. Another famous trapper known to have frequented the area was Kit Carson. The Gunnison survey party explored the area in 1853, but was later wiped out by a retaliatory Indian attack in eastern Utah. These early trappers, traders, and explorers left little trace of their passing, other than their notes, maps, diaries and the occasional historic artifact left on the ground.

The transition from the Prehistoric period to the Historic period was from approximately 1875 to 1881, with the removal of the Utes and rapid immigration of miners, homesteaders, and stockmen into

the area. The first settlers in the Norwood area began arriving in 1878 and were primarily stock growers and homesteaders. Little mining activity occurred in the analysis area. (Most mining was primarily restricted to precious metal mining in areas south [San Juans] and east [Lake City and Gunnison area]). Placer mining by early prospectors did occur on a very limited basis, in the early 1880's, in the Ragged Mountain area of the North Fork Valley. The remains of this activity are primarily restricted to occasional deteriorated cabins, historic artifacts associated with mining activities, and tales of lost gold mines and discovered Spanish gold. Mining began in earnest in the North Fork Valley, with the discovery of coal by I. Sanborn, in 1883, which led to the opening of the Somerset and Bowie coal mines in the Late 19th/Early 20th Century. The coming of the railroad to the North Fork Valley, in 1902, opened up new markets for the coal, and the area continued to grow and develop. Other early coal mining operations in the area were the Bardine-Anthracite Community above the Somerset mine and the Floresta coal camp near Kebler Pass. Floresta opened in the 1880's and closed in 1926. Coal mining continues in the North Fork Valley today.

The Uncompahgre Plateau and Grand Mesa were used freely in these early settlement years as grazing lands for cattle and sheep. Stockmen began moving into these areas before the final Ute removal in 1881. The heyday of the large stock growing outfits in the analysis area was from roughly 1881 to the Panic of 1893. The establishment of the Battlement Mesa Timber Land Reserve in 1892 restricted grazing use of the Grand Mesa and no doubt contributed to the downfall of the "Cattle Baron" era. Free use of the Uncompahgre Plateau continued a little longer until the Uncompahgre National Forest was established in 1906. Homesteading began in earnest in the North Fork Valley and surrounding areas around 1906, and reached its height from 1910-1916. Early ranching communities within this area include West Muddy, Pilot Knob, Hubbard and Terror Creeks, and Stephens Gulch. Disputes between cattlemen and sheepmen within the analysis area were numerous but never developed into range wars as seen in other parts of the west.

Fort Crawford, south of present day Montrose, was built in 1880 to manage the removal of the Utes from the area. The towns of Montrose and Delta were established in 1881. Numerous roads were constructed by lumbermen, stock growers and freighters in the 1880's, primarily over the Uncompahgre Plateau. Some of these that are still in use today are the Divide Road, the Dave Wood Road, the Delta-Nucla Road and Highway 90. The first road to the top of the Grand Mesa was built in 1891 and was used primarily to move cattle to high summer pastures. In 1925 the first automobile was driven to the top. The road over Kebler Pass was constructed from 1917-1920 and was intended to be a railroad grade to move coal out of the North Fork Valley. Lack of investors led to an abandonment of the idea.

Early sawmills were located throughout the analysis area. On the Uncompahgre Plateau, the Darling sawmill supplied lumber to the growing communities of Delta and Montrose, and to Fort Crawford. The Roatcap and Edner sawmills around Kebler Pass, supplied lumber to local settlers and to the developing coal mines in the North Fork Valley in the late 1890's and early 1900's.

Federal activity in the area began in 1892 with the creation of the Battlement Forest Reserve, which included the Grand Mesa. It was later renamed the Grand Mesa National Forest when the National Forest System was created in 1905.

Most of the early historic resources on the Forest date to this Late 19th Century/Early 20th Century time period, and are related to homesteading, stock raising, and lumbering activities. Historic resources in the analysis area include abundant ditches with associated flumes and sluices, homesteaders and stockmen's cabins (especially in the Norwood/Lone Cone and West Muddy Pass areas), cow camps and corrals, sawmills, developed natural springs, carved aspen tree art and historic trash dumps. Other historic resources on the Grand Mesa built in the Early 20th Century are the Leon Peak Fire Lookout (1911-1912), the Leon Tunnel (1900) and several reservoirs. The Leon Peak Fire Lookout and Leon Tunnel have been recommended as eligible for the National Register of Historic Places.

The last major historic periods represented in the study area are the CCC construction period and the recreation and tourism period. CCC construction projects are found throughout the Uncompahgre

Plateau and Grand Mesa. These construction projects include Forest Service Guard Stations such as Silesca, Lone Cone, and Columbine on the Uncompahgre Plateau, and Lands End Observatory, Mesa Lakes, Ward Lake and Collbran Guard Stations on the Grand Mesa. Other CCC era historic resources on the Grand Mesa include the Lands End Road and CCC camps at Coon Creek, Skyway, Trickle Park, and Lands End. On the Uncompahgre Plateau, another CCC era resource is the Divide CCC camp. The Lands End Observatory has been recommended as eligible to the National Register of Historic Places.

The recreation and tourism period is represented on the Grand Mesa by the remains of numerous early recreational cabins and lodges constructed around Ward Lake, Alexander Lake and Mesa Lakes. In 1891, a commercial fishing operation was established at Alexander Lake by W. Alexander and R. Forrest. Theirs was one of the first resorts established on the Grand Mesa, the other being Mesa Lakes, which is mentioned as a resort as early as 1887. Forrest and Alexander sold their facilities and lakes to a man named Radcliff in 1896 who built Alexander Lake Lodge and several cabins, and subsequently closed Alexander Lake to fishing by the public. After an incident over a trespasser being shot, the lodge and associated cabins were burned by angry local residents and Radcliff never returned.

The Grand Mesa Resort Company acquired Radcliff's interests on the Grand Mesa and combined it with land they already had, in 1911, creating a 320 acre recreation unit. Numerous privately owned recreational cabins found around Alexander and Eggleston lakes, were part of this resort and are still in use today during the summer months. Other commercial operations currently operating under special permit with the Forest Service are the Grand Mesa Lodge, built in 1947; and Spruce Lodge, built in the 1930's. Recreational use of the Grand Mesa has continued up to today with the establishment of the Mesa Ski Area in 1938 and the Powderhorn Ski Area in 1966. The Mesa Ski Area closed in the 1950's, but Powderhorn Ski Area continues to operate today. None of these recent structures, cabins and features are presently considered eligible to the National Register of Historic Places.

Proposed Silesca Ranger Station Complex Historic District: This Ranger Station has been determined eligible to the National Register of Historic Places. The garage/office combination building, barn, rail worm fence, and features are all contributing elements to this proposed district. The Silesca Ranger Station was the first one built on the newly created Uncompahgre National Forest in 1906. It was also the residence of the first forest ranger on the Uncompahgre National Forest. The features around the pond are believed to be associated with an early socialistic settlement. The combination building and barn were built by the CCC in the 1930's and are largely unmodified. The complex covers 185 acres of the Forest.

Environmental Factor: Wildlife

The Forest is located within the Rocky Mountain Forest Ecoregion of the Highland province, and includes four major climatic and vegetation zones: lower montane forest, upper montane forest, subalpine forest, and alpine vegetation.

Common vegetation types occurring from low to high elevation are: sagebrush; pinyon-juniper; Gambel oak (oakbrush); ponderosa pine; Douglas fir; aspen; Engelmann spruce/subalpine fir and alpine. Some white fir and lodgepole pine stands are found within the analysis area, but are rather limited. These vegetation types provide habitat for a large number of wildlife species.

Riparian zones traverse through all of the vegetation types and are the most important single habitat type for wildlife. These riparian zones are used as travel routes, as foraging areas, cover areas, and as a source of water.

Generally a diverse mosaic of vegetation and physical land features provides for excellent habitat for wildlife. The Forest's varied habitat supports approximately 300 wildlife species. Approximately 90 of these species are hunted or trapped. The remaining species provide wildlife viewing opportunities, in addition to their role as components of the ecosystem in which they are found.

Big Game

Mule Deer (Odocoileus hemionus): Mule deer are found throughout the entire analysis area and are the most common big game animal within the analysis area. They can be found at all elevations in summer and fall, and concentrate on winter ranges during winter and spring. Mule deer are found in forested habitats and open shrub habitats such as oakbrush, pinyon-juniper, sagebrush, and mixed browse habitats. The largest concentrations can be found on the Uncompahgre Plateau and the Grand Mesa. The area has one of the largest mule deer populations in the United States. The extent of mule deer winter range is limited on the Forest; hence, it is critical for these animals. Winter ranges usually feature a combination of browse species, favorable southern exposure, and topographic and vegetative features that provide thermal cover, security, and escape cover. The mule deer herd is somewhat stable or in a slightly downward trend, despite a series of mild winters in recent years. The reasons for this population trend have not been determined, but may be related to competition, access, hunting pressure, habitat conditions, etc. Mule deer concentrate in small groups to large herds on their winter ranges, where they browse primarily on Gambel oak, sagebrush, mahogany, serviceberry, bitterbrush, chokecherry, juniper and other browse species. Sagebrush is a key food and cover species during the winter months.

Mountain Lion (Felis concolor): The mountain lion is a relatively common species within the analysis area. The healthy mule deer population subsequently supports a good mountain lion population, particularly on the Uncompahgre Plateau, in the West Elk area, and elsewhere, where deer concentration areas exist. The lion occupies all habitat types within the analysis area. Lions, particularly males, have extremely large home ranges that can encompass territories of up to 100 square miles. Young, two to three, are usually born in mid summer but may be born during any part of the year. Young bearing and rearing usually occurs in rugged rocky country where natural caves or rock overhangs are present. Key habitats include: denning areas and mule deer concentration areas.

Bighorn Sheep (Ovis canadensis canadensis): Bighorn sheep are found in the Battlement Mesa area on the north end of the analysis area. This herd once numbered over 200 animals but now may number only about 25 sheep (Cunningham, 1991). Reasons for the decline may be attributed to vegetative changes, intensive livestock grazing in the 1950's, poaching, and an increasing elk herd. This bighorn sheep herd resides on both sides of Battlement Mesa, which is administered by the Grand Mesa, Uncompahgre and Gunnison National Forests and the White River National Forest. Because the species is in such a decline, the entire range of this species is deemed critical for its survival. Winter ranges for the species are generally located west of Anderson Gulch and summer range is north and east of Anderson Gulch.

During the winter, the bighorns are concentrated at lower elevations where grasses, forbs, and browse species are plentiful.

The Battlement Mesa herd is unique in that it is one of the few Rocky Mountain sheep herds that is found at an elevation more typical of desert bighorn habitat. Small body size and small tightly curled horns characteristic of this herd are also not typically found in Rocky Mountain bighorns. This may be a characteristic of a herd that is in decline and of low vigor (Cunningham, 1991). Key habitats include: migration routes, lambing ranges, winter range, bedding sites, breeding sites, sources of water, and mineral licks.

Desert Bighorn Sheep (Ovis canadensis nelsonii): The desert bighorn has been reintroduced into the Roubideau Canyon area on the Uncompahgre Plateau, within the analysis area. This reintroduction took place in the fall of 1991. At least two more supplemental transplants will occur within the next year to augment this herd. This, once indigenous species, was eliminated from its historic range by the turn of the century. These animals' habitat requirements are similar to those of the Rocky Mountain bighorn sheep except that they can withstand drier habitat conditions. Needs for escape cover, forage and security habitat are similar to those of the Rocky Mountain bighorn. It is

expected that this species will occupy the entire Roubideau drainage and expand into adjacent suitable habitat. Key habitats are similar to those of the Rocky Mountain bighorn sheep.

Elk (Cervus elaphus): Rocky Mountain elk are found in substantial numbers in all portions of the analysis area where habitat provides security and forage to meet its needs. The elk herd on the Forest is one of the largest herds in North America and is extremely important, both from an economic and esthetic standpoint. Sport hunting of elk is of major economic importance to this area.

Wildlife viewing is also of major importance and becomes more popular each year. Elk prefer secure habitats with an abundance of thick cover for security, ample forage, and very limited accessibility by humans. Habitat effectiveness is strongly influenced by the amount of human use and associated activities that occur within a particular area. The frequency and timing of disturbances are important factors. Elk congregate in large herds during the winter, at lower elevations on south or southwest facing slopes. Their preferred food is grass throughout the entire year. Herds during the winter may number up to 300 animals or more, and are frequently found wintering on bare grassy ridges or hillsides in pinyon-juniper, sagebrush, or Gambel oak habitat types. A substantial amount of the analysis area is within the winter range of elk on Grand Mesa, the south end of the Uncompahgre Plateau, and in the Crawford and Paonia areas. In spring, the elk move fairly rapidly to the higher country as snow cover recedes. Elk calving occurs from early-May to late-June. The oakbrush, sagebrush, and aspen ecosystems contain most of the calving areas. Aspen and oak areas interspersed with small ponds are important calving and nursery sites. After calving the cows and calves gather into large nursery groups at higher elevations where disturbance from humans is very low. During the summer and early fall, elk are generally found at high elevations where fall breeding activity occurs. Spruce-fir habitats where roads or other human activity is minimal is preferred habitat. Elk can easily be prematurely moved to their winter ranges by human related activity, early snowfalls, or a lack of forage. Migration to winter ranges is often very fast and over distinct migration routes and travel corridors. These migration routes have been mapped in some locations. Key habitats include summer concentration areas, elk wallowing areas, winter ranges, migration routes, calving areas, and fall breeding areas.

Mountain Goat (Oreamnos americanus): The mountain goat is found only in the Marcellina Mountain and Ragged Peak areas within the area under analysis. The mountain goat population is very small and roams the high rocky alpine terrain of these and adjacent peaks during the summer and fall. In late fall the goats move to lower slopes and wind blown ridges. Breeding usually occurs from November to early December. Mountain goats are generally confined to very steep rocky country where they feed on high elevation grasses and grasslike plants. In winter and early spring they will make use of some mahogany, mountain maple, willow, and aspen. Young, usually one, are born in traditional kidding areas from May 15th to June 15th. Key habitats include natural mineral licks where important minerals are obtained, kidding grounds, traditional wintering areas and migration routes that are used year after year.

Black Bear (Ursus americanus): The black bear is fairly common throughout the entire analysis area. Oakbrush habitats are the most commonly used habitat type within the analysis area. Black bear are especially common in the West Elk Mountains and on the Uncompahgre Plateau. A black bear study in the analysis area found that the black bear density was estimated at 1 bear/5.6 square kilometers (Beck, 1991). Home ranges ranged up to 200 square kilometers for females and 400 square kilometers for males. Mast, the fruit acorn of the Gambel oak, is a primary food source for black bears within the analysis area. Berry producing shrubs such as chokecherry, serviceberry, and currant are also important components of bear habitat. Black bears den primarily in rock caverns and enter these dens in late October or early November. Young black bear, usually one, are born in these dens in January and remain in the den until emergence in April. Illegal killing of black bear is increased where unrestricted access occurs through prime foraging habitat. Key habitats include: denning habitat, mast producing areas, and secure fall foraging areas.

Wild Turkey (Meleagris gallopavo): Wild turkey are found primarily in the Gambel oak and ponderosa pine habitat types in all areas covered in this analysis. Fair to good populations of wild turkey

are found on the Uncompahgre Plateau, Grand Mesa, Battlement Mesa, and around Crawford. Populations at one time were very high, but were reduced by disease and are just now making a comeback. Nesting occurs in the ponderosa pine or Gambel oak habitats from April to June. Optimum nesting habitat contains downfall from ponderosa pine that provides nest concealment. Mast is a primary source of food within the aspen, ponderosa pine, and Gambel oak habitat types. Key habitats are mast producing oaks, roost sites, and winter foraging areas where snow depths are not excessive.

Pronghorn Antelope (Antilocapra americana): Antelope can be found in the lower elevational areas of the Forest that consist of grassland habitats adjacent to the pinyon-juniper habitat type. The range of this species on the Forest is somewhat limited because of its habitat preference for open grasslands, sagebrush ecosystems, and shrublands found at lower elevations. However, some populations occur within the analysis area on the Uncompahgre Plateau and on the Grand Mesa. Forbs, shrubs, and some grasses are the primary food items for this species. Because this animal is found at lower elevations there is not a great distance between summer and winter ranges. In some areas the species is a year-round resident. Antelope fawns, usually twins, are born between the 1st and 15th of June. Sagebrush habitats are preferred for fawning because of the cover it provides the young when first born. Water is an important feature of antelope habitat. Water holes are used more that once daily. Key habitat features include winter foraging areas, water holes, and fawning sites.

Moose (Alces alces): Moose have been recorded in the historic files from the Grand Mesa and Paonia areas. Apparently a few moose inhabited or wandered through this area from populations to the North. These infrequent inhabitants were apparently wiped out in the early 1900's. Moose have been transplanted to adjacent Forests and will undoubtedly become more numerous in the future. Moose are generally sedentary animals and are associated with riparian willow bottoms.

Upland Game Birds

A wide variety of game birds reside within the analysis area. The white-tailed ptarmigan *(Lagopus leucurus)* can be found in alpine habitats in the Lone Cone area, the Raggeds and on the highest mountains on the east end of Grand Mesa. Blue grouse *(Dendragapus obscurus)* can be found in the spruce-fir, ponderosa pine, and aspen ecosystems throughout the analysis area. Lower elevational habitats such as the pinyon-juniper and sagebrush are also often used, especially during the spring nesting season.

Chukars *(Alectoris graeca)* and Gambel's quail *(Lophortyx gambelii)* are found in localized areas within the analysis area at lower elevational zones in the driest of habitats. A localized population of sharp-tailed grouse *(Pedioecetes phasianellus)* occurs on the north end of the Uncompahgre Plateau. These birds seen to prefer brush draws with deciduous vegetation.

Sage grouse (*Centrocercus urophasianus)* are also present and are discussed under Management Indicator Species.

Small Game

Small game mammals within the analysis area include: both desert and mountain cottontail rabbit (*Sylvilagus auduboni* and *S. nuttalli*) can be found in all habitat types except the alpine (desert cottontail in lower elevations, mountain cottontail in higher elevations); the snowshoe hare *(Lepus americanus)* inhabits all forested habitats; and the red squirrel *(Tamiasciurus hudsonicus)* is most commonly found in the spruce-fir habitat.

Furbearers

A number of furbearers are found within the analysis area and include the red fox *(Vulpes fulva)*, beaver *(Castor canadensis)*, coyote *(Canis latrans)*, badger *(Taxidea taxus)*, longtail weasel *(Mustela frenata)*, ermine *(M. erminea)*, mink *(M. vison)* and .bobcat *(Lynx rufus)*.

Riparian habitats are very important to several of these species. The ponds constructed by beavers provide very beneficial habitat for a large number of bird, mammal, fish and amphibian species. The marten *(Martes americana)* is discussed under Management Indicator Species and lynx *(Felis lynx canadensis)* and wolverine *(Gulo gulo luscus)* are discussed under Threatened and Endangered Species.

Other Wildlife

In all there are approximately 300 species of fish and wildlife found in the various habitats represented on the Forest.

Management Indicator Species

Certain wildlife species found in specific vegetation types have been selected to represent the habitat needs of a larger group of species requiring similar habitats. The Forest Plan has identified these as management indicator species. These species were selected because they have special habitat needs that may be influenced significantly by management practices resulting from land use allocations, and because these species represent the habitat requirements of other species or groups of species. These are the management indicator species which represent the late successional stages of the various vegetation types found within the area being analyzed:

Colorado River Cutthroat Trout (Oncorhynchus clarki pleuriticus), Rainbow Trout (Oncorhynchus mikis) and Brown Trout (Salmo trutta): The Colorado River cutthroat trout, rainbow trout and brown trout are listed in the Forest Plan as indicator species because of their sensitivity to changes in aquatic and/or riparian habitat conditions. Rainbow trout are important indicators because of their economic value, brown trout are important as indicators of the environmental requirements of other aquatic species and Colorado River cutthroat trout are important as representatives of TE&S fish species. All of these trout species prefer aquatic habitat with good water quality, clean substrate and moderate stream temperatures with abundant overhead and instream cover. Because of their sensitivity to environmental disturbances, these species are quick to respond to external perturbations.

Pine Marten (Martes americana): The pine marten represents the late successional stage of old growth spruce-fir forests, particularly the down woody component of these forests. The marten is generally nocturnal and is active throughout the year. It is most abundant in mature to old growth spruce, fir, and lodgepole pine forests. It will also utilize aspen forests that are intermixed with spruce and fir. Young (1-4) are born in April in natal dens found in logs, stumps, and large snags. The red-backed vole *(Clethrionomys rutilus)* and the meadow vole *(Microtus pennsylvanicus)* are staple food prey. Red squirrels and other small mammals are also important food items. Population densities of marten in good habitat vary by geographic location. In Glacier National Park, in Montana, mean home range size was estimated to be 1.0 square miles for resident males and 0.27 square miles for resident females (Hawley and Newby 1957, Burnett 1981). Larger home range sizes have been reported in other areas: in Minnesota, six square miles for males and 1.7 square miles for females was recorded (Mech and Rogers 1977). Marten are easily trapped and are susceptible to overharvesting by trappers. One of the greatest threats to viable populations of pine marten is the construction of roads into their habitat.

Goshawk (Accipiter gentilis): The goshawk represents the mature aspen successional stage and is a good indicator of certain types of old growth habitat. It occupies coniferous and mixed forest habitats, in addition to the aspen ecosystems. Goshawks seem to select for specific structural characteristics in nest trees and nesting stands. Goshawk nesting territories include 2-5 nest trees per nest territory. These nest trees are almost always within 0.6 miles of each other (Reynolds, 1975). Goshawk nest stands have consistently been described as mature to old growth. Forest stands selected for nesting may be either multi-storied or single story. Stands are characterized by having high basal areas, open understory, gently to moderately steep slopes, on northerly aspects, and are fully stocked with trees. Nest trees are often in very old large aspen trees that have an understory of coniferous trees.

Prey items include red squirrels, Abert's squirrels *(Sciurus aberti)*, snowshoe hares, cottontail rabbits, ground squirrels, blue grouse, woodpeckers, jays, robins *(Turdus migratorius)*, and others. Goshawk home ranges can be from 1-4 miles apart (Shuster and others, 1976).

Abert's Squirrel (Sciurus aberti): The Abert's squirrel is found primarily on the south end of the Uncompahgre Plateau and south of Norwood in the Naturita and Lone Cone areas. The Abert's squirrel is unique in that it is almost totally dependent on the ponderosa pine - its food and cover requirements are met solely by this species of pine tree. The Abert's is very closely associated with the mature ponderosa pine vegetation type. Stands that average between 11 and 13 inches diameter at breast height and have a basal area of between 150 and 200 square feet/acre are preferred nesting sites (Patton, 1977). A few Abert's squirrels can also be found on the north end of the Plateau. Ideal habitat for this squirrel is an all-aged stand of ponderosa pine. They prefer to build their nests 30-50 feet above the ground in mature ponderosa pine trees. Abert's squirrels have and use more than one nest in their home range. Stick nests, tree cavities, and witches brooms are used for young rearing. The primary food of the Abert's squirrel include seeds, buds, terminal twigs, cones, and inner bark of ponderosa pine. A ground cover of 80% or more in ground litter is desirable.

Red Crossbill (Loxia curvirostra): The red crossbill is an management indicator species for coniferous forest types, particularly the mature spruce and Douglas-fir forests. However, this species is common to ponderosa pine, pinyon, and other pine forests in the area. The species often flies in flocks, feeding on the seed of the coniferous cones. They have specialized bills to extract seeds from unopened cones of coniferous trees. Nests are well concealed in coniferous trees, usually ten feet or more off the ground and often near the tops of the trees.

Hairy Woodpecker (Dendrocopos villosus): The hairy woodpecker is a primary cavity nesting species which represents the mature lodgepole pine vegetative type. However, the hairy woodpecker is also associated with the aspen, spruce-fir, and mixed deciduous and coniferous forests of this area. This woodpecker feeds on boring insects under the bark of trees. This woodpecker excavates new nesting cavities each year. Abandoned cavities provide suitable nesting sites in subsequent years for a large number of secondary cavity nesting species such as the mountain bluebird *(Sialia currucoides)*, mountain chickadee *(Parus gambeli)*, tree swallow *(Iridoprocno bicolor)*, purple martin *(Progne subis)*, and many others.

Lewis' Woodpecker (Asyndesmus lewis): The Lewis' woodpecker is an semi-colonial species that represents the mature mountain shrub vegetative association, particularly where ponderosa pine and Gambel oak stands are present. Open park-like stands of trees with brushy understories are the preferred habitat for the species.

The species is also a primary cavity nester, preferring trees that are at least 15" in diameter. Insects form the principle food items in spring and summer. Fruits and berries are also eaten in the summer, and Gambel oak acorns are utilized during the winter. The species migrates altitudinally within the analysis area as a result in changes in it's food supply.

Sage Grouse (Centrocercus urophasianus): The sage grouse represents the late successional sagebrush vegetation association. Sage grouse can be found in the sagebrush/grassland habitats on the Forest. Sage Grouse Leks or traditional strutting/breeding grounds are extremely important to the survival of the species in any particular area. Some leks have been identified, however, leks can still be found and must be protected. Leks generally range is size from five to forty acres. While leks are usually surrounded by sagebrush, the strutting area may be somewhat sparsely to moderately vegetated with sagebrush. Barring the complete elimination of the physical lek itself, the leks are used generation after generation. In late February and March, male sage grouse begin to gather from wintering sites to traditional leks.

Breeding generally occurs on the leks during late March and April. This is subsequently followed by nesting and young rearing in May, June, and July. Sage grouse hens will build the nests in the vicinity

of a lek, within 7-10 days following breeding. These nests are normally under sagebrush plants where they are protected from late spring storms. The young feed on insects such as beetles and ants and gradually begin to forage on succulent plants. As summer approaches the sage grouse move to higher elevations where more succulent green vegetation is still plentiful; however, they never get too far from the sagebrush ecosystem. As winter approaches, the sage grouse move to lower elevations or wind blown slopes where snow depths are shallow. The extent of winter movement depends solely on food and cover availability as it relates to snow depths. Sage Grouse Leks have been identified in the Miramonte Reservoir area.

Pinyon Jay (Gymnorhinus cyanocephalus): The pinyon jay is a management indicator species for the mature pinyon-juniper vegetation association. It is a colonial nester in the pinyon-juniper habitats within the analysis area. The pinyon jay feeds primarily on the seeds of the pinyon pine. Mature cone bearing trees are important habitat as they provide the primary source of food for this pinyon pine dependent bird. Pinyon-juniper habitats are very common at the lower elevational zones on both sides of the Uncompahgre Plateau and on the Grand Mesa.

Threatened, Endangered and Sensitive Species

See discussion on page III-101 of this chapter.

Environmental Factor: 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 harvest 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.

Environmental Factor: Economic Setting

The area is generally rural and sparsely settled, with the exception of the commercial and population centers at Grand Junction and Montrose. Other communities in the area, such as Delta, Collbran, Norwood and Paonia have populations less than 5,000.

Agriculture is a dominant land use in the area. The area surrounding the analysis area was first settled in the late 1800's by ranchers and farmers. Ranching and farming are still important and basic industries dependent on the Forest for livestock grazing and water resources. In response to agricultural needs and community growth, water resources have been developed on the Forest for irrigation and domestic use.

Coal, uranium, and hard rock mining has occurred in and about the Forest since the area was first settled. Some communities are still somewhat dependent on the mining industry. Oil and gas

exploration has generally been a seasonal activity and has not contributed much to maintaining a stable workforce.

Timber is not a major industry in the area; however, it is a significant industry in some communities. Timber harvest on the Forest contributes receipts to the counties based on the gross receipts from timber sales. Counties also receive funds from other activities on the Forest, such as land use and recreation permits, mineral permits, leases and sales, recreation user fees and grazing fees.

In the past, communities in the area have been dependent on single industries. Diversification of the local economies has occurred through the development of light industry, retail and wholesale trade, and tourism. Tourism ranks as a major employer in the area. Tourists are attracted yearround to recreational opportunities that include big game hunting, fishing, skiing, sightseeing and camping. The attraction is based mostly on the natural, unpolluted environment. Retirees are settling in the area for some of the same reasons.

Floodplains

There are approximately 10,200 acres of this environment within the analysis area.

This is the strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks. It is built of alluvium carried by the river during floods and deposited in the sluggish water outside the influence of the swiftest current. A river has only one floodplain but may have one or more terraces representing abandoned floodplains.

Within the analysis area, floodplains will vary from very wide, when associated with low gradient, high sinuosity meadow streams, to almost non-existent when associated with steep, low sinuosity headwater streams. Floodplains may be well vegetated or barren gravel bars. Alpine and montane floodplain vegetation is dominated by a number of herbaceous and woody shrub species, with cottonwood and spruce being the most common tree species. Floodplain alluvium varies from very fine clay size material to large boulders, depending upon position within the watershed, valley gradient, watershed geology and recent flooding history.

A river needs access to its floodplain to allow for energy dissipation during flood events, in order to preserve the stability of the low flow channel. Floodplains aid in the absorption of flood flows and reducing downstream impacts. They also serve as important links in the recharging of groundwater aquifers. Floodplains are the physical feature on the landscape that most often support a variety of beneficial uses associated with rivers and streams. In many instances, floodplains qualify as wetlands and almost always are considered riparian areas.

Floodplain management and protection responsibilities for Federal agencies was established by Executive Order 11988, signed by President Carter on May 24, 1977. It directs the Forest Service and all other Federal agencies to avoid to the extent possible, the long and short term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.

By controlling what part of the floodplain may be used or what type of use may occur, the potential for water quality impacts can be reduced. The shallow groundwater table within floodplains is easily contaminated. This water is an important contributor to late season base flows in the nearby stream. The outer portions of a floodplain may be inundated only once every 50 to 100 years. Access roads within this portion of a floodplain would not contribute appreciably to water quality impacts during these rare flood events. Some incidental uses may be acceptable along the outer edges of the floodplain. However, location of well sites or storage sites within the floodplain, with all the potential pollutants contained

therein, would not be appropriate. Removal of gravel from floodplains would also be an inappropriate practice.

Aquatic / Riparian / Wetland Habitats

Environmental Factor: Fisheries and Aquatic Habitat

Aquatic ecosystems are the stream channel, lake or estuary bed, water, biotic communities and the habitat features that occur therein (FSM 2526.05). The Forest's aquatic resources consist of 3,657 miles of perennial stream (fisheries) habitat. These stream miles are associated with approximately 89,000 acres of riparian habitat. In addition to this, there are 1,400 miles of major intermittent streams associated with over 24,000 acres of riparian habitat. These "major" intermittent streams normally have the potential to support an extensive riparian ecosystem, the condition of which varies throughout the Forest. There are approximately 1,500 miles of streams and nearly 3,000 surface acres of lakes within the analysis area.

The Forest's fisheries resources consist primarily of the various trout species, such as brook *(Salvilinus fontinalis)*, brown *(Salmo trutta)*, rainbow *(Oncorhynchus mikis)* and cutthroat (*O. clarki).* Non-game fish species include suckers, dace and sculpin which occur in a variety of aquatic habitats throughout the analysis area. These species are found in a variety of coldwater habitats which range from *riverine habitats,* characterized by clear, cold water; a silt free rocky substrate in riffle-run areas; an approximately 1:1 pool riffle ratio with areas of slow, deep water; well vegetated stream banks; abundant instream cover; and relatively stable water flow, temperature regimes and streambanks; to *lacustrine habitat,* which is characterized by clear, cold, deep lakes that are typically oligotrophic, but may vary in size and chemical quality, particularly in reservoir habitats.

Many of the stream miles and lake acres may not fall within these "optimal" descriptions because of land use activities resulting in increased sediment loads, vegetative loss, increased stream temperatures, wide shallow stream profiles and silt-choked substrates. However, there are no current inventories that adequately describe the conditions of these streams and lakes, so a description of the physical habitat would range from a low gradient, meandering stream with a silt/sand/gravely substrate to ones with a steeper gradient and a gravel/rubble/cobble substrate. Stream profiles range from well confined, cascading step-pool types, to unconfined, wide and shallow streams.

The Colorado Division of Wildlife has an extensive fish stocking program throughout the Forest, and much of their emphasis is on the lakes and streams found in the analysis area. The existing resident fisheries are supplemented through CDOW's stocking efforts to enable these fisheries to support the heavy recreational use in the area. This program will probably continue in the future and is expected to increase as the recreating public increases the demand on these resources.

The Forest is cooperating with the Colorado Division of Wildlife in developing a conservation plan for the Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus).* This species is a U.S. Fish and Wildlife Category 2 candidate species, listed in the Federal Register, Vol. 54, No. 4, Friday, January 6, 1989. Historically, this species was found throughout the analysis area, but these populations have been extirpated and, at the current time, there are only isolated populations found outside the analysis area. Many of the stream miles associated with the analysis area provide suitable habitat for the Colorado River cutthroat trout, and these streams are the target for future inventories.

The streams and lakes within the analysis area provide habitat for other aquatic organisms, as well as fish. The many aquatic and semi-aquatic macroinvertebrates are an integral part of the aquatic resources of the Forest, and provide the major food source for fisheries throughout the Forest, as well as the analysis area. These organisms also function as indicators of environmental health and will respond to subtle changes in aquatic habitat much more dramatically than the resident fish populations.

The various functional groups found in healthy communities are reflective of habitat quality and are widely used in monitoring the over-all condition of aquatic systems.

The recreational fisheries within the analysis area, especially those lake fisheries on the Grand Mesa, are becoming high use areas for the many resident and non-resident anglers that visit the area. The Forest is planning extensive recreational developments and habitat improvements to draw more recreationists into the area and improve user distribution. Many of the streams coming off Grand Mesa are outstanding recreational fisheries and are getting increased use.

In general, the current condition of the aquatic habitat associated with the analysis area has not been established. The Forest is now in the process of inventorying the aquatic and riparian resources to determine what their condition is. The only aquatic inventories that have been conducted, historically, have been associated with site specific project work and may not reflect the general condition of the aquatic ecosystems within the analysis area. Once the on-going inventories have been completed, determinations can be made concerning present condition.

Environmental Factor: Riparian Habitats

The Forest's riparian resources consist of nearly 185,000 acres of riparian vegetation, made up primarily of willow, cottonwood, alder, grasses and forbs, sedges and rushes, conifers and other species. Within the analysis area, there are approximately 32,000 acres of riparian area associated with the 1,400 miles of stream. These areas are not portrayed on maps in this document because of the scale of such mapping. They generally follow stream courses and water bodies observable on 1:24,000 scale maps produced by U.S. Geological Survey.

The riparian ecosystems are "transitional areas" between the aquatic ecosystem and the adjacent terrestrial ecosystem; identified by soil characteristics or distinctive vegetation communities that require free or unbound water, or a high water table, at some time during the growing season. They are characterized by species and/or life forms that are different from those of the immediately surrounding non-riparian climax area, and include streams, lakes and wet areas, and the adjacent vegetative communities which are predominantly influenced by their association with water.

Riparian plant associations have been previously discussed as elevational components of the conifer, deciduous, woodland, shrubland, grassland, and forbland plant communities. Because of the high level of sensitivity and management concerns related to the riparian life zones, plant associations, specifically common to riparian habitats, are repeated here and stratified by elevation.

Plant Association:

Alpine and Sub-Alpine

Netleaf Willow *(Salix reticulata)* / Golden Avens *(Acomastylis rossii)*
Heartleaf Bittercress *(Cardamine cordifolia)* / Elkslip Marshmarigold *(Caltha leptosepala)*
Parry Primrose *(Primula parryi)* / Tufted Hairgrass *(Deschampsia cespitosa)*
Grayleaf Willow *(Salix glauca)* - Willows *(Salix spp.)* / Sedges *(Carex spp.)*
Water Sedge *(Carex aquatilis)* / Elephant Head Lousewort *(Pedicularis groenlandica)*
Elkslip Marshmarigold *(Caltha leptosepala)* / Rosecrown Stonecrop *(Clementsia rhodantha)*
Planeleaf Willow *(Salix phylicifolia)* / Elkslip Marshmarigold *(Caltha leptosepala)*
Siberian Kobresia *(Kobresia sibirica)* / Viviparous Bistort *(Bistorta vivipara)*
Cliff Sedge *(Carex scopulorum)* / Elkslip Marshmarigold *(Caltha leptosepala)*
Planeleaf Willow *(Salix phylicifolia)* / Cliff Sedge *(Carex scopulorum)*
Planeleaf Willow *(Salix phylicifolia)* / Water Sedge *(Carex aquatilis)*

Black Alpine Sedge *(Carex nigricans)* / Rushes *(Juncus spp.)*
Bog Birch *(Betula glandulosa)* / Skunkleaf Polemonium *(Polemonium pulcherrimum)*
Teachers Sedge *(Carex praeceptorum)* / Water Sedge *(Carex aquatilis)*
Tufted Hairgrass *(Deschampsia cespitosa)* / Sedges *(Carex spp.)*
Water Sedge *(Carex aquatilis)* / Beaked Sedge *(Carex utriculata)*
Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce *(Picea engelmannii)* / Arrowleaf Groundsel *(Senecio triangularis)*

Montane

Bog Birch *(Betula glandulosa)* / Cliff Sedge *(Carex scopulorum)*
Water Sedge *(Carex aquatilis)* / Hood Sedge *(Carex hoodii)*
Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce *(Picea engelmannii)* / Rocky Mountain Maple *(Acer glabrum)*
Baltic Rush (Juncus articus) / Sedges *(Carex spp.)*
Thinleaf Alder *(Alnus incana)* / Drummond Willow *(Salix drummondiana)* / Field Horsetail *(Equisetum arvense)*
Subalpine Fir *(Abies lasiocarpa)* - Engelmann Spruce *(Picea engelmannii)* / Bluejoint Reedgrass *(Calamagrostis canadensis)*
Brookgrass *(Catabrosa aquatica)* / Water Sedge *(Carex aquatilis)*
Red-osier Dogwood *(Swida sericea)* / Bearberry Honeysuckle *(Distegia involucrata)*
Geyer Willow *(Salix geyeriana)* - Willows *(Salix spp.)* / Bluejoint Reedgrass *(Calamagrostis canadensis)*
Thinleaf Alder *(Alnus incana)* / Red-osier Dogwood *(Swida sericea)*
Colorado Blue Spruce *(Picea pungens)* / Saskatoon Serviceberry *(Amelanchier alnifolia)* - Red-osier Dogwood *(Swida sericea)*
Narrowleaf Cottonwood *(Populus angustifolia)* / Coyote Willow *(Salix exigua)* - Water Birch *(Betula fontinalis)*
Bearberry Honeysuckle *(Distegia involucrata)* / Bluejoint Reedgrass *(Calamagrostis canadensis)*
Bluejoint Reedgrass *(Calamagrostis canadensis)* - Cliff Sedge *(Carex scopulorum)* / Mountain Bluebell *(Mertensia ciliata)*
Tufted Hairgrass *(Deschampsia cespitosa)* / Elkslip Marshmarigold *(Caltha leptosepala)*
Mountain Bluebells *(Mertensia ciliata)* / Tufted Hairgrass *(Deschampsia cespitosa)*
Drummond Willow *(Salix drummondiana)* / Bluejoint Reedgrass *(Calamagrostis canadensis)*
Narrowleaf Cottonwood *(Populus angustifolia)* / Thinleaf Alder *(Alnus incana)* / Red-osier Dogwood *(Swida sericea)*

The condition of the riparian acres on the Forest ranges from poor to good. The Forest is in the process of conducting inventories to determine the current condition of these areas and, once established, will be able to document trend. The only data available that can be used to address the current conditions of the 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 riparian ecosystems associated with the analysis area.

Soils in riparian areas are frequently young, in a geologic sense, and are usually formed in alluvial deposits. However they may be found in narrow headwater and broad valley positions, as well as land depressions not associated with running water. True riparian soils are considered hydric soils, which means they are periodically saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper portion of the soil profile. Another common characteristic is an accumulation of organic matter. These conditions result in a soil called a Histosol, which means being derived from organic materials (the term histic epipedon is used to describe the heavy accumulations of organic material in the upper portions of the soil). In these situations, the upper part

of the profile is saturated for 30 or more days, during the growing season. Because of their moisture content, soils in riparian areas are susceptible to damage by a variety of ground disturbing activities.

Riparian areas provide habitat for a variety of aquatic, semi-aquatic and terrestrial species of wildlife. Fish and other aquatic organisms are highly dependent on healthy riparian systems which provide cover, temperature control, organic input, filtering of pollutants and resting and rearing habitat for a variety of species. The importance of these areas for wildlife habitat, as well as domestic use, has been well documented throughout the literature. Healthy riparian systems are an integral part of the functioning of the total watershed, in that they help maintain water quality, protect soils from erosional processes, provide forage for wildlife and domestic use and preserve the stream channel and watershed stability.

Environmental Factor: Wetlands

There are approximately 27,600 acres of this environment within the analysis area.

Unlike floodplains, wetlands is not a term for a physical landform feature, but rather comprises an entire ecosystem, determined by a number of physical and biological factors. Wetlands can be found in conjunction with almost any surface and shallow subsurface water feature. There is considerable overlap in definition between wetlands and riparian areas. Most literature indicates that the term wetland is more limited than riparian. In other words, all wetlands would qualify as riparian areas, but not all riparian areas would qualify as a wetland.

Wetlands are extremely productive and important ecosystems. The availability of solar energy, nutrients and water creates an environment that produces tremendous biological diversity, in both plants and animals. Many of these are at the bottom of the food chain and thus are critical to supporting other animals. In addition to the food base, wetlands provide habitat needs for many fish and wildlife species. Wetlands can protect or improve water quality by filtering out sediment and heavy metals. They also have the capability of removing nutrients, particularly nitrogen and phosphorus, through uptake by wetland plant communities. They are also effective at reducing impacts from floods, by reducing velocity and absorbing water. In addition to these basic values they are attractive places frequently used by Forest visitors, who enjoy a variety of activities associated with wetlands. Some of the more popular activities include nature viewing and study, environmental education, fishing, hunting, canoeing and hiking.

Wetlands has a more legal and regulatory context than riparian areas. This is based upon Executive Order 11990, which was also signed by President Carter on May 24, 1977. For the purpose of regulating activities that potentially may impact wetlands, a Federal Manual was developed jointly by the U.S. Corp of Engineers, the Soil Conservation Service, the Environmental Protection Agency and the U.S. Fish and Wildlife Service. This manual defines jurisdictional wetlands and was adopted in January of 1989. At the present time, modifications to the manual are proposed, but nothing has been finalized. In general, wetlands are defined by the presence of: permanent or seasonal water; water loving vegetation; and soil characteristics influenced by saturated conditions. All three of these conditions must exist in order to qualify as a wetland.

Wetlands within the analysis area are found in conjunction with streams, lakes, springs, bogs and marshes. These range from areas permanently submerged with emergent vegetation to areas which are only seasonally saturated at the surface following snowmelt and vegetated by sedges, rushes and willows. The top of the Grand Mesa has extensive wetlands, although many have been lost as a result of inundation behind dams. Glacial action over the gentle topography on top of Grand Mesa resulted in many shallow depressions remaining after the ice melted. Abundant snowfall provides water to fill these depressions, which over time, became wetland ecosystems. Other areas within the analysis area have fewer acres of wetland and they are for the most part associated with streams. Most of these streams are small, with moderate to steep gradient which results in narrow floodplain development where wetlands are most likely to occur.

Alpine / Tundra Areas

There are approximately 2100 acres of this environment within the analysis area. Figure III-5 is a reduced scale map showing the approximate location of these areas.

Alpine ecosystems occur on three high elevational areas in the southwest portion of the area. These include Lone Cone, Groundhog Mountain, and Little Cone. In these cases, the alpine ecosystem starts at around 11,300 feet and goes to the top of the mountains. Additional alpine ecosystems can be found on Carbon Peak, Mount Axtell and Whetstone Mountain. Alpine ecosystems on these locations start a 11,500 feet.

Alpine ecosystems occur from what is referred to as timberline, to the tops of high mountain peaks, ridges, and crests. These areas have extremely short growing seasons, cold overall temperatures, very large daily temperature fluctuations, high intensity solar radiation exposure, and are subject to periodic high winds. Due to these very harsh conditions, the soil forming process is extremely slow. Very little soil development has occurred in the 10 to 15 thousand years since glaciers have ceased to be a major geomorphic agent in the analysis area. The soil that is there is usually shallow to moderately deep, relatively acidic, contains large amounts of gravel, cobble and stone, and is usually very low in fertility. Due to these environmental factors, alpine areas are very fragile ecosystems.

Alpine vegetation consists of a variety of low-growing herbaceous, forbs, grasses, shrubs, and lichen species that have adapted specifically to the harsh growing conditions. Large unvegetated areas of rock outcrop, talus slopes and rock glaciers also occur.

Alpine areas are valued for their scenic qualities, high elevational recreational and educational opportunities; and in the west, possible barometers of the effects of air pollution. Because of the lack of any vegetation for screening, any disturbances are obvious.

The wildlife habitat provided by this type supports elk, bighorn sheep and mountain goats. Ptarmigan and pika are unique to the type.

Livestock, particularly sheep, graze the alpine in designated range allotments.

Due to extremely harsh growing conditions, low soil fertility and unavailability of appropriate adapted vegetative materials or seed sources, these areas are extremely hard to revegetate. This can be visually observed in disturbances that date back 100-120 years ago. It may take 200-300 years, if ever, until the ecosystem is back to a predisturbance state.

Areas of High Geologic Hazard

There are approximately 52,000 acres of this environment within the analysis area. Figure III-6 is a reduced scale map showing the approximate location of these areas.

A geologic hazard is "a naturally occurring or man-made geologic condition or phenomenon that represents a risk or is a potential danger to life and property" (American Geological Institute Glossary of Geology). A geologic hazard inventory of most of the Forest and all of the analysis area, has been completed. The geologic hazards were identified through aerial photograph interpretation, review of existing geologic literature, and a general knowledge of the geology of the Forest. Only very limited ground truthing was done. Field investigation may be required to verify the geologic hazards that were mapped based on aerial photograph interpretation. Changes may be necessary, based on subsequent field checking. The methods and guidelines for geologic hazard mapping that were used to map the Forest are those employed by the US Geological Survey and Colorado Geological Survey. Note also, that earthflows, mudflows and landslides which have a general north-facing aspect or occur in heavy vegetation are difficult to map relying solely on the methods used. In other words, there may be some

areas that should be mapped as High Geologic Hazard that may not have been, due to the limitations of the methods used, or some of the areas mapped as High Geologic Hazard may not be so. These issues will be resolved at the APD, site-specific stage, when the lessee submits a proposed Surface Use Plan of Operations for approval.

A High Geologic Hazard area has a high level of major geologic or geomorphic activity or instability, or has a high potential for such activity, either naturally or due to disturbance by management activities. Major disturbances in these areas have a high probability of causing unacceptable resource damage. Active mudflows, earthflows, and landslides, and areas prone to avalanche are categorized as High Geologic Hazard areas.

Areas of Moderate Geologic Hazard

There are approximately 629,000 acres of this environment within the analysis area. Figure III-7 is a reduced scale map showing the approximate location of these areas.

Moderate Geologic Hazards are those failed slopes that are no longer active (stabilized earthflows, mudflows, and landslides); those slopes adjacent to failed slopes or active earthflows, mudflows or landslides and avalanche chutes; areas of rockfall; flash flood zones, and areas with potential mining related problems (i.e. subsidence, acid drainage). There may be some areas that should be mapped as Moderate Geologic Hazard that may not have been due to the limitations of the methods used, or some of the areas mapped as Moderate Geologic Hazard may not be identified as such during the field review. These issues will be resolved at the APD, site-specific stage, when the lessee submits a proposed Surface Use Plan of Operations for approval.

Moderate Geologic Hazards are found throughout the analysis area, but are commonly found associated with those areas of High Geologic Hazard. Those areas underlain by the Mancos Shale, the Wasatch Formation, and clay soils derived from the Morrison Formation are potentially subject to slope failure, as a result of management activities. The contact zone between the Mancos Shale and the overlying Mesaverde Group rocks also tends to be prone to slope failure.

Areas above past and present coal mining activities may be subject to subsidence. The majority of the coal mining in the analysis area occurs within the Mesaverde Group along the flanks of Grand Mesa, and in the North Fork of the Gunnison River valley around Paonia and to the east towards McClure Pass.

Roadless Areas

Table III-11 summarizes the acres of Roadless Areas within the analysis area. Figures III-8a and III-8b are maps with the individual Roadless Areas identified.

The RARE I and RARE II processes, completed in 1979, inventoried and evaluated for possible Wilderness designation, 19 Roadless Areas in the analysis area. In 1980, approximately 157,530 acres of RARE II inventoried lands in the analysis area were classified as Wilderness by the Colorado Wilderness Act (Public Law 96-560). The act did not identify any additional study areas in the analysis area. All other lands inventoried as roadless in the RARE I and II processes were released for non-Wilderness management.

TABLE III-11. ROADLESS AREAS WITHIN ANALYSIS AREA

Roadless Area Number - Name	1 Net Acres	2 Acres Designated Wilderness	3 Net * Analysis Area Acres	4 Wilderness Attribute Rating **	5 MAUM's	6 Timber MMBF	7 Areas of High Public Interest	8 Acres Under Current Oil & Gas Lease	9 Areas with Planned Timber Management
181 - Raggeds	96,760	43,060	16,300	H	1.4	70.0		5,025	
182 - Drift Creek	13,800	0	9,100	M	.3	107.5		4,875	X
184 - Springhouse Park	17,045	0	17,045	L	.8	169.0		0	X
185 - Electric Mountain	7,850	0	7,850	L	.3	120.0		590	X
186 - Clear Creek	41,350	0	41,350	H	2.3	348.0	X	30,765	X
189 - Hightower	4,100	0	4,100	M	.1	0		995	
191 - Priest Mountain	92,955	0	92,955	M	4.5	1002.5	X	28,295	X
192 - Salt Creek	11,305	0	11,305	M	.8	173.5		4,705	X
193 - Battlement Mesa	36,290	0	36,290	H	1.8	191.5		9,970	
194 - Nick Mountain	10,845	0	10,845	M	.8	114.5		3,720	X
195 - Kannah Creek	34,575	0	34,575	M	1.2	120.0	X	990	
196 - West Elk	206,940	176,000	28,295	H	.5	44.0	X	705	
200 - Whetstone Mountain	15,400	0	13,100	M	.5	216.5	X	1,915	
201 - Flat Top Mountain	19,800	0	110	M	.9	34.0		0	
241 - Roubideau	19,800	0	6,485	M	1.0	89.5	X	0	
242 - Tabeguache	10,200	0	8,385	H	.5	66.0	X	964	

TABLE III-11. ROADLESS AREAS WITHIN ANALYSIS AREA

Roadless Area Number - Name	1 Net Acres	2 Acres Designated Wilderness	3 Net * Analysis Area Acres	4 Wilderness Attribute Rating **	5 MAUM's	6 Timber MMBF	7 Areas of High Public Interest	8 Acres Under Current Oil & Gas Lease	9 Areas with Planned Timber Management
243- Kelso Mesa	28,430	0	1,205	M	1.7	11,375		0	
246 - Campbell Point	11,300	0	395	M	.1	7.8		0	
247 - Johnson Creek	10,300	0	5,340	M	.1	10.2		1,115	
TOTAL			345,030					94,629	

1. Net acres in Roadless condition (Source: 1991 Plan Amendment)
2. Acres of Congressionally designated Wilderness
3. Acres of this area within the Analysis Area for this EIS which are in roadless condition
* Net Analysis Area acres may not be the mathematical sum of previous two columns. This is because not all acres of each Roadless Area are within the analysis area.
4. Wilderness Attribute Rating from RARE II.
**Rating shown as: H = High (19+), M = Medium (16-18), L = Low (15-)
5. AUM's - Average annual grazing use of entire Roadless Area (including designated Wilderness)
6. Timber - Total standing volume of merchantable timber within Roadless Area (does not account for possible unsuitability of land for timber harvest for other reasons).
7. Areas with high public interest - areas which have been mentioned in proposed legislation in the past 10 years
8. Acres under current oil and gas leases.
9. Areas within which timber harvest activities have been scheduled under the current Forest Plan.

Roadless Area 181 - Raggeds

Size and Location: As inventoried in RARE II, the Raggeds Roadless Area was approximately 134,000 acres. This included approximately 14,000 acres on the White River National Forest. The Raggeds Wilderness was created by P. L. 96-560 (12/22/80). Approximately 43,000 acres on the Grand Mesa, Uncompahgre and Gunnison National Forests and 16,400 acres on the White River National Forest were designated Wilderness. Approximately 16,000 acres of the Raggeds Roadless Area remain within the analysis area.

This remaining area is split into two separate segments. The larger is east of Paonia Reservoir, lying between the Forest boundary and the Raggeds Wilderness boundary. It extends north to the vicinity of Lee Creek and State Highway 133 (McClure Pass). To the south,it extends to Erickson Springs Campground.

The smaller segment is located north of the Kebler Pass Road, near Horse Ranch Park, approximately 3 miles northwest of Kebler Pass. This segment also abuts the boundary of the Raggeds Wilderness.

Oil and Gas Leasing: There are eight existing oil and gas leases occupying approximately 5,025 acres within the Roadless Area. There has been no ground disturbing activity within the Roadless Area on these leases. All of the leases are in the area east of Paonia Reservoir. None of the leases are in the Horse Ranch Park segment.

The potential for oil and gas within the area is high on 10,000 acres and low on 6,000 acres.

Suitable Timber: The Forest Plan identifies suitable timber acres in the north end of the Roadless Area east of Paonia Reservoir, at the head of Chair Creek. No timber sales are currently scheduled for this area.

The area also contains timber that is currently not suitable because of economics. The segment near Horse Ranch Park contains timber not suitable because of the sensitivity of the area.

TABLE III-12. NUMBER OF ACRES BY TIMBER SUITABILITY TYPE WITHIN ROADLESS AREAS IN ANALYSIS AREA

Roadless Area Number - Name	Total Acres within Analysis Area	Timber Suitability				
		Suitable		Economically Not Suitable		Sensitive Not Suitable
		Aspen (Acres)	Conifer (Acres)	Aspen (Acres)	Conifer (Acres)	
181 - Raggeds	16,300	1,305	550	1,910	275	200
182 - Drift Creek	9,100	1,545	0	2,550	125	0
184 - Springhouse Park	17,045	6,310	410	2,310	35	0
185 - Electric Mountain	7,850	1,995	800	1,290	1,645	0
186 - Clear Creek	41,350	7,285	3,615	6,845	1,905	335
189 - Hightower	4,100	1,495	0	0	0	0
191 - Priest Mountain	92,955	10,870	16,445	0	3,815	1,400
192 - Salt Creek	11,305	1,185	2,690	0	235	0
193 - Battlement Mesa	36,290	0	0	9,190	0	0
194 - Nick Mountain	10,845	0	1,770	0	390	1,360
195 - Kannah Creek	34,575	0	745	0	0	4,170
196 - West Elk	28,295	0	0	0	0	1,780
200 - Whetstone Mountain	13,100	885	1,515	700	5,325	70
201 - Flat Top Mountain	110	55	5	35	0	0

TABLE III-12. NUMBER OF ACRES BY TIMBER SUITABILITY TYPE WITHIN ROADLESS AREAS IN ANALYSIS AREA

Roadless Area Number - Name	Total Acres within Analysis Area	Timber Suitability				
		Suitable		Economically Not Suitable		Sensitive Not Suitable
		Aspen (Acres)	Conifer (Acres)	Aspen (Acres)	Conifer (Acres)	
241 - Roubideau	6,485	810	630	0	0	0
242 - Tabeguache	8,385	160	690	0	0	1,000
243 - Kelso Mesa	1,205	0	0	845	100	0
246 - Campbell Point	395	0	0	0	0	0
247 - Johnson Creek	5,340	70	0	0	0	0
TOTAL	345,030	33,970	29,865	25,675	13,850	10,315

Management Direction: The Forest Plan Management Areas included within the segment east of Paonia Reservoir are: 2A Semi-primitive Motorized Recreation, 4B Wildlife Habitat for Indicator Species, and 6B Livestock grazing.

The segment near Horse Ranch Park includes 2,565 acres of management area 3A Semi-primitive Non-motorized Recreation.

Natural Integrity: In the segment east of Paonia Reservoir, natural process have been influenced by the construction of irrigation systems near Tomahawk Reservoir and Williams Lake, the dozer constructed Munsey-Ruby Stock Driveway, and a road (FDR 898) from McClure Pass to private land near Grouse and Buck Creeks. While all of the Roadless Area is open to grazing, natural processes in the areas away from the direct influence of this construction are intact and continuing.

Natural processes are likewise intact and continuing in the Horse Ranch Park area. This area is open to sheep grazing. The Dark Canyon Trail (830) was once a jeep trail but is now restricted to non-motorized travel.

Apparent Naturalness: Once away from the construction described under Natural Integrity, the area east of Paonia Reservoir appears natural.

The Horse Ranch Park area lacks the constructed improvements found east of Paonia Reservoir. The removal of motorized use from Trail 830 is returning it to a more natural appearance. The area appears natural.

Remoteness: Vehicle use in both segments is restricted to designated routes. FDR 898 and a portion of Trail 820, both east of Paonia Reservoir, are designated as open. There are no open routes in the Horse Ranch Park area.

East of Paonia Reservoir, there is no public access across the private land onto the National Forest. The only public access is along FDR 898 at the north end of the area and along the trails leading into the area from BLM land in the middle of the area, and from Erickson Springs, at the south end of the area.

The Horse Ranch Park area is accessed by Trail 830 from the Horse Ranch Park Trailhead; by Trail 837 from Lake Irwin, approximately 1.5 miles to the east; and by an informal mountain bike trail. Vehicle travel along the Kebler Pass Road can be heard within the area. The subdivision on the private land near Floresta is visible from vantage points along The Dyke. The Horse Ranch Park Trailhead is among the highest use trailheads on the Paonia District. These factors combine to diminish the sense of remoteness in this area.

Solitude: East of Paonia Reservoir, the lack of access lends a sense of solitude. The private land to the west is ranch land. Fall big game outfitters day pack into the area from this private land; but summer ranching activities do not detract from the feeling of solitude.

The National Forest to the east is the Raggeds Wilderness. This portion of the Wilderness is the steep rocky face of the Raggeds. Travel within this portion of the Wilderness is very difficult, approaching technical rock climbing. Little use occurs in this portion of the Wilderness which include both the Pristine (8A management prescription) and Primitive (8B management prescription) settings. The solitude present within the Wilderness influences the sense of solitude in the adjacent Roadless Area.

The feeling of solitude is lessened by the motorized recreation use on the designated open routes, mechanized maintenance of the constructed improvements described under Natural Setting, and the ongoing subdivision of the private land (into 40 Acre cabin sites) accessed by FDR 898 . Solitude is lessened at the points of public access by the increased number of human encounters at these locations. The feeling of solitude is less during the fall big game seasons when overall recreation use increases within the area.

The Horse Ranch Park area is managed for a Semi-primitive Non-motorized recreation setting. Areas with this setting generally have greater opportunities for experiencing solitude. However, the existing trail system and the summertime use that occurs on the trails, limits the feeling of solitude. There is a high probability of encountering others while within the area.

Special Features: An area of mass slope instability lies north of Tomahawk Reservoir. The one mile wide, 3 mile long area slipped during 1986.

Within the Horse Ranch Park area the ponds along Trail 830 are an attraction for fishing and recreation. Trailhead registrations indicate that they are a frequent destination of trail users.

The Dyke contributes to the mountainous and scenic character of this area.

Manageability/Boundaries: East of Paonia Reservoir the Roadless Area is long and narrow (2 to 4 miles wide, 11 miles long) and lies between the private land and the Raggeds Wilderness. Established irrigation systems, motorized routes and private land within the area break up this narrow remnant of Roadless Area 181. The existing Raggeds Wilderness boundary avoids these features.

The Horse Ranch Park segment lies between the Kebler Pass Road to the west and south, Lake Irwin and its associated roads and campground to the east and the Raggeds Wilderness to the north. It's management for a Semi-primitive Non-motorized (3A Management Area) setting is similar to that of the adjacent Wilderness.

Special Places/Special Activities: Old growth aspen of 80 to 120 years, found in the vicinity of Horse Ranch Park, generates special feelings for this area. This was evident during the review of the recent Forest Plan Amendment.

A special use permit for entomological research is located very near the Roadless Area, at Horse Ranch Park. The area of 22 acres is permitted to Michael Zimmerman of Oberlin College, Oberlin, Ohio. Permits of this type have been located here since 1979.

Roadless Area 182 - Drift Creek

Size and Location: As inventoried in RARE II, the Drift Creek Roadless Area was approximately 13,800 acres. This included approximately 4,700 acres on the White River National Forest and 9,100 acres on the Grand Mesa, Uncompahgre and Gunnison National Forests. None of the Roadless Area has been designated Wilderness.

All of the Roadless Area on the Forest is within the analysis area.

The area is located to the north of State Highway 133 (McClure Pass). The highway separates it from the Raggeds Roadless Area to the south. A one mile wide corridor separates it from the Clear Creek Roadless Area 186 to the north. The hydrologic divide between Muddy Creek and the Crystal River marks the boundary between the White River and Grand Mesa, Uncompahgre and Gunnison National Forests and forms the eastern boundary of the analysis area. The Roadless Area crosses the forest boundaries in this location. The remainder of the Roadless Area is bounded by the Forest boundary with private land.

Oil and Gas Leasing: There are nine existing oil and gas leases occupying approximately 4,875 acres within the Roadless Area. There has been no ground disturbing activity on these leases.

The potential for oil and gas within the area is high.

Suitable Timber: The Forest Plan identifies suitable timber scheduled for commercial timber sales within the area, during the next decade. Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

Management Direction: The Forest Plan Management Areas included within the area are: 2A Semi-primitive Motorized Recreation, 2B Roaded Natural and Rural Recreation Opportunities (along the highway corridor to McClure Pass), and 6B Livestock Grazing.

Natural Integrity: In addition to being leased for oil and gas, portions of the Roadless Area have been leased for coal. Coal exploration has occurred during the 1950s, 1960s and 1980s. The Mid-Continent Coal Mine is located on the White River National Forest and produces high BTU coking coal. Most surface mine facilities are located on private land within the White River National Forest. Natural processes are intact and continuing, but could be affected by subsidence caused by coal mining.

Irrigation systems are located within the area near the private land boundary and Roberts and Drift Creeks. These improvements affect natural process immediately adjacent to them.

Apparent Naturalness: Once away from the evidence of coal exploration and the irrigation systems the area appears natural. Some roads from coal exploration are visible when looking into the area, from above.

Remoteness: Access into the area remains difficult because the coal mine and the presence of private land, both on the White River and this Forest, block public access. Public access is available from McClure Pass or from the Clear Creek area to the west. The area is managed as open to off-road and off-trail travel. ATV use occurs within the area.

Solitude: Use of the area is heaviest during the fall big game seasons. The sense of solitude is less then than during the summer season, when there is little use because of the lack of attractions. The area nearest to the McClure Pass Highway is affected by the sight and sound of traffic, lessening the feeling of solitude.

Special Features: The lack of road access open to the public makes the area attractive to wildlife; which in turn attracts hunting use during the fall big game seasons. This area is also visible from Highway 133.

Manageability/Boundaries: The boundaries formed by the private land and the McClure Pass highway are well defined. There is no private land within the area on the Forest. The White River portion is broken by the Mid-Continent Coal mine and its private land. A continuous stringer of private land bisects the area, extending from Placita along Highway 133, to Huntsman Mountain, to the north.

The potential for activities on existing oil and gas leases and on existing coal leases limits the potential to manage the area to maintain its roadless character.

Special Places/Special Activities: None.

Roadless Area 184 - Springhouse Park

Size and Location: As inventoried in RARE II, the Springhouse Park Roadless Area was approximately 17,000 acres. The Roadless Area is entirely on the Forest. None of the Roadless Area has been designated Wilderness.

All of the Roadless Area is within the analysis area.

The area is located two miles north of Somerset. Springhouse Park is in the geographic center of the area. The east, south and west boundaries of the area are formed by the National Forest boundary abutting private and BLM administered land. The north boundary is a line separating the Roadless Area from roaded National Forest System land in the West Muddy Creek and Pilot Creek drainages.

Oil and Gas Leasing: There are no existing oil and gas leases within the Roadless Area.

The potential for oil and gas within the area is high.

Suitable Timber: The Forest Plan identifies suitable timber within the area, scheduled for commercial timber sales during the next decade. Approximately 7,000 acres are suitable. Another 2,300 acres are not suitable because of uneconomical access. Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

No timber sales have yet occurred.

The Floating Lake timber sale is tentatively schedule for FY 94. Preliminary scoping for this sale has occurred. Preparation of an EIS is underway. The proposed sale consist of 885 acres and 8.8 MMBF of aspen harvest. An estimated 18 miles of road would be constructed.

Management Direction: The Forest Plan Management Areas included within the area are: 4D Aspen Management, and 6A and 6B Livestock Grazing.

Natural Integrity: The coal mines located near Somerset do not extend into the Roadless Area.

Open roads within and adjacent to the area include numbers 503, 704, and 783. FDR 503 extends into the center of the Roadless Area, to Springhouse Park. Trails 804 and 806 are open to motorized trail vehicles. Two plugged and abandoned coal bed methane wells are located near the north boundary of the area. The gravel well pads were reclaimed for dispersed recreation and are used as parking areas accessed by FDR 704.4A.

The area is open to grazing.

A solar powered Forest Service radio site is located within the area, approximately 1 mile west of Springhouse Park.

Once away from the constructed facilities described above, natural process are intact and operating.

Apparent Naturalness: Once away from the constructed facilities described under Natural Integrity, the area appears natural.

Remoteness: The area is not remote. The previously described open routes provide ready access into the area. Access along routes coming from the south requires four wheel drive. From the north, routes are passable with two wheel drives. Vehicle use is restricted to routes designated as open.

Solitude: Use of the area is heaviest during the fall big game seasons. The sense of solitude is less during the hunting season than during the summer season, when there is little use within the area, because of the lack of attractions. The ease of motorized access eliminates the feeling of solitude.

Special Features: There are no special features is this Roadless Area.

Manageability/Boundaries: The area is broken by the established motorized use on the access routes previously described.

Special Places/Special Activities: None identified.

Roadless Area 185 - Electric Mountain

Size and Location: As inventoried in RARE II, the Electric Mountain Roadless Area was approximately 7800 acres. The Roadless Area is entirely on the Forest. None of the Roadless Area has been designated Wilderness.

All of the Roadless Area is within the analysis area.

The area is located 10 miles northwest of Somerset. Electric Mountain is near the center of the area. The south boundary of the area is the National Forest boundary. The other boundaries are formed by roads and private land inholdings that encircle Electric Mountain.

Oil and Gas Leasing: There are existing oil and gas leases within the Roadless Area. These leases occupy approximately 590 acres.

The potential for oil and gas within the area is high.

Suitable Timber: The Forest Plan identifies suitable timber within the area, scheduled for commercial timber sales during the next decade. Approximately 2,800 acres are suitable. Another 2,900 acres are not suitable because of uneconomical access. Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

No timber sales have yet occurred.

Management Direction: The Forest Plan Management Areas included within the area are: 6B Livestock Grazing, and 7A Wood Fiber Production.

A Utility Corridor (Management Area 1D) lies immediately to the west of the Roadless Area. One mile of this corridor forms the Roadless Area boundary. This corridor is currently occupied by one 230 KV powerline.

The area is open to grazing.

Natural Integrity: Roads surround the area. The powerline and its associated road are adjacent to a portion of the area. An irrigation ditch near Beaver Creek, is within the area. One trail, open to motorized trail vehicles, crosses through the area. There are no other developments within the area.

Natural processes are intact and continuing.

Apparent Naturalness: Once away from the constructed facilities described under Natural Integrity, the area appears natural.

Remoteness: Though the area currently retains its roadless character it is not remote because it is surrounded by roads. Vehicle travel within the area is not restricted by the current travel plan.

Solitude: Use of the area is heaviest during the fall big game seasons. The sense of solitude is less during the hunting season than during the summer season. Hunting camps would be encountered frequently around the edges of the area. Encounters could be expected within the area. There would not be much sense of solitude.

There are no attractions that stimulate summer use. The feeling of solitude would be greater during the summer.

Special Features: There are no special features within the area.

Manageability/Boundaries: Though the area is small and is surrounded by roads, the roads do not penetrate into the area. It is possible to manage its roadless character by not constructing roads into the area.

Special Places/Special Activities: None identified.

Roadless Area 186 - Clear Creek

Size and Location: As inventoried in RARE II, the Clear Creek Roadless Area was approximately 41,300 acres. The Roadless Area is entirely on the Forest. None of the Roadless Area has been designated Wilderness.

All of the Roadless Area is within the analysis area.

The area is located 20 miles north of Paonia. It contains the headwaters of the East Fork of Muddy Creek, the Clear Fork , Crooked Creek, and Crane Creek.

A portion of the boundary of the Roadless Area is formed by the Forest boundary with the White River National Forest. Other boundaries avoid the nearby roads, such as Buzzard Divide (FDR 265) and Owens Creek (FDR 268). Also along the western boundary, paralleling the Buzzard Divide road, is a Utility Corridor containing a 230 KV powerline.

The area is separated from Roadless Area 182 by a one mile wide corridor in Henderson Creek. It is contiguous with Roadless Area 183, located on the White River National Forest, which consists of 22,200 acres. It is separated from Roadless Area 189 by a narrow corridor along the Owens Creek Road.

Oil and Gas Leasing: There are thirty existing oil and gas leases within the Roadless Area. These leases occupy approximately 30,765 acres.

The potential for oil and gas within the area is high.

Four producing gas wells are located within or immediately adjacent to the Roadless Area. Gas pipelines servicing these wells have been constructed within the Roadless Area. An additional well was

drilled, plugged and abandoned within the area. One additional Application for Permit to Drill (APD) has been approved.

Suitable Timber: The Forest Plan identifies suitable timber within the area, scheduled for commercial timber sales during the next decade. Approximately 11,000 acres are suitable. Another 9,000 acres are not suitable because of uneconomical access. Another 335 acres are not suitable because of visual sensitivity.

Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

The Ruth Mountain timber sale,locate between Ruth Mountain and Owens Creek adjacent to the northwest corner of the Roadless Area, is currently active. The Crooked Creek timber sale, located within the Roadless Area east of Buzzard Creek and south of Ruth Mountain, is tentatively scheduled for FY 94. Data collection on this proposed sale took place during 1992. Preparation of an EIS began during the fall of 1992.

Management Direction: The Forest Plan Management Areas included within the area are: 6B Livestock Grazing, and 7A Wood Fiber Production. Management Area 3A Semi-primitive Non-motorized Recreation occurs on approximately 1,600 acres. Management Area 1D Utility Corridor, forms approximately seven miles of the western boundary of the Roadless Area. This corridor is occupied by a 230 KV powerline and associated roads.

The area is open to grazing.

Natural Integrity: The area has been affected by oil and gas exploration, the drilling of producing wells, and the construction of gas pipelines to service them. A gas pipeline enters the area from the White River National Forest, approximately two miles northwest of Elk Knob. Approximately four miles of road were built to a gas well from the White River National Forest. This well was located near the confluence of Second Creek and the Clear Fork. The well was plugged and abandoned and the road was closed. Approximately four miles of water transmission ditch exist in that same area.

Away from these disturbances, natural processes are intact and continuing.

Apparent Naturalness: Once away from the constructed facilities described under Natural Integrity, the area appears natural.

Remoteness: Most of the area is managed as open to motorized travel only on designated routes. The roads constructed as part of oil and gas exploration are not open to general travel, but are restricted to oil and gas and administrative use. Roads open to public use surround the area but do not penetrate to its interior.

The drainages of Crane Creek, Crooked Creek and Turner Creek are open to travel both on and off roads and trails.

The 3A Management area south of Spruce Mountain and including Muddy Basin, is managed for a Semi-primitive Non-motorized recreation setting.

The size of the area and the limited access retain a feeling of remoteness in the area away from the direct influence of the constructed facilities.

Solitude: Once away from the ongoing oil and gas activity, the area continues to provide opportunities for solitude. Restriction on motorized access and the lack of motorized access into the center of the area maintains these opportunities.

Special Features: Many places within the area contain unstable soils.

The area provides summer habitat for elk and is popular during the fall big game seasons. Four outfitters use the area. Two of these outfitter have base camps within the area. The other two day pack into the area.

On the Paonia District, this is the most roadless Roadless Area.

Manageability/Boundaries: The area is large enough to maintain its naturalness. Open roads do not penetrate into the area. Continued oil and gas development, especially the continued drilling of producing wells, could alter the character of the area so much that it would loose its remoteness, solitude and overall roadless character.

Special Places/Special Activities: The area is special in that it is a proven producer of natural gas. The potential for further development is very high.

Roadless Area 189 - Hightower

Size and Location: As inventoried in RARE II, the Hightower Roadless Area was approximately 32,000 acres. This included approximately 27,000 acres on the White River National Forest and 4100 acres on the Grand Mesa, Uncompahgre and Gunnison National Forests. None of the Roadless Area has been designated Wilderness.

All of the Roadless Area on the Forest is within the analysis area.

The area is located north of the Buzzard Divide and Owens Creek Roads. It extends from these roads up to and across the forest boundary with the White River National Forest.

Oil and Gas Leasing: There are existing oil and gas leases occupying approximately 995 acres within the portion of the Roadless Area on this Forest. There has been no ground disturbing activity within the Roadless Area on these leases. An APD was submitted but not implemented.

The potential for oil and gas within the area is high.

Suitable Timber: The Forest Plan identifies suitable timber within this area. Table III-12 displays the number of acres by timber suitability type, within the Roadless Area.

The currently active Ruth Mountain timber sale is adjacent to the eastern portion of the Roadless Area.

Management Direction: The majority of the Roadless Area is in Forest Plan Management Area 6B Livestock grazing. A Utility Corridor (Management Area 1D) forms a portion of the Roadless Area boundary. The Buzzard Divide Road FDR 265 has been relocated from its original location near Buzzard Creek to near this Utility Corridor and the edge of the Roadless Area.

Natural Integrity: The Utility Corridor is currently occupied by a 230 KV power line and its associated roads. This power line forms the boundary of the Roadless Area. The Ruth Mountain timber sale is adjacent to but outside what remains of the originally inventoried Roadless Area. An irrigation system taking water out of Owens Creek is likewise adjacent to but outside the Roadless Area. Since these disrupting influences are outside the Roadless Area, the Roadless Area has retained its natural integrity.

Apparent Naturalness: Once away from the 230 KV powerline the area appears natural.

Remoteness: The portion of the area on the Forest is not remote. It is adjacent to the Utility Corridor, Buzzard Divide Road and Owens Creek road. There are numerous non-system travel ways

that are used by ATV's and motorcycles. The fence separating the White River National Forest and this Forest is paralleled by a non-system route passable to pickup trucks.

Solitude: The area does not offer an opportunity for experiencing solitude. Use is very heavy during the fall big game seasons. Use of the area during the summer is light because there are no summer attractions. Although there will be few encounters with others during the summer, the sense of solitude is diminished by the nearby Buzzard Divide and Owens Creek Roads.

Special Features: There are not special features within the Grand Mesa, Uncompahgre and Gunnison National Forests' portion of the Roadless Area, other than this area provides good summer big game range.

Manageability/Boundaries: The remaining Roadless Area within the Forest is small and bounded by roads, timber activity and the Utility Corridor. It is not manageable by itself for its roadless characteristics.

Special Places/Special Activities: The specialness of the Forest's portion of the Roadless Area appears to be its desirability for fall big game hunting.

Roadless Area 191 - Priest Mountain

Size and Location: As inventoried in RARE II, the Priest Mountain Roadless Area was approximately 102,600 acres. The area is currently mapped as occupying approximately 93,000 acres. The Roadless Area is entirely on the Forest. As a result of RARE II, Priest Mountain received a non-wilderness recommendation. None of the Roadless Area has been designated Wilderness.

All of the Roadless Area is within the analysis area.

The area is located 12 miles southeast of Collbran. This large area is spread out over three Ranger Districts (Grand Junction, Paonia, and Collbran). It includes the areas of the Flat Tops, the East Fork of Leon Creek, Currant Creek, Cunningham Creek, Cow Creek above Overland Reservoir, and Priest Mountain.

Oil and Gas Leasing: There are existing oil and gas leases within the Roadless Area. These leases occupy approximately 28,295 acres and are concentrated in the north end of the Roadless Area.

The potential for oil and gas within the area is high.

Suitable Timber: The Forest Plan identifies suitable timber sales during the next decade, within this area. Approximately 11,000 acres of suitable aspen and 16,400 acres of suitable conifer are included in the Roadless Area. Approximately 3800 acres are not suitable for economic reasons, and 1400 acres are not suitable because of visual sensitivity. Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

The proposed Monument timber sale is located in the northeast corner of the Roadless Area, north of Bronco Knob but south of Willow Creek. This sale is tentatively scheduled for FY 97. Access to the sale would come from Buzzard Creek and the Willow Creek Road FDR 263.

The Terror Creek Second Decade Vegetation Treatment Environmental Assessment and the Stevens Gulch Road and Related Timber Sales Environmental Impact Statement describe a series of timber sales scheduled for the Cunningham Creek, Terror Creek, Middle Hubbard and Little Dyke Creek areas. These sales are located below the Overland Ditch and are scheduled from 1992 to beyond 1997.

Management Direction: The Forest Plan Management Areas included within the area are: 3A Semi-primitive Non-motorized Recreation, 4B Wildlife Management, 4D Aspen Management, 6B Livestock Grazing, and 7A Wood Fiber Production.

The area is open to grazing.

The 3A prescription occupies 4800 acres within the Roadless Area, in the upper Cow Creek drainage.

Different portions of the area vary in their retention of roadless qualities. The least affected areas include the 3A Management Area, the Currant Creek vicinity and the Flat Tops. The most modified areas include the areas east and south of the of the Overland Ditch, the vicinity of the Stevens Gulch Road FDR 701, and Cunningham Creek.

Rather than describing each roadless quality (Natural Processes, Natural Appearance, Remoteness, Solitude, etc.) for Priest Mountain as a whole, it is easier to discuss the area location by location, describing the roadless qualities of each location. (See Figure III-8a)

Currant Creek

Location: Currant Creek is located in the southwest corner of the Roadless Area. It is bordered on the west and south by the Forest boundary with private land. It is separated from the remainder of the Priest Mountain Roadless Area by a corridor around the Green Mountain Trail. Its east boundary avoids Patterson Reservoir and the road leading to it.

Natural Integrity: Natural processes are in place and continuing. There is little evidence of human induced change.

Apparent Naturalness: The area looks natural.

Remoteness: The area is bordered on the south by the National Forest boundary with private land. There is no public access across this private land.

To the north, this area is bounded by the Green Mountain Trail. Access into the Currant Creek vicinity must come down from this trail. While the trail is open to ATV and motorcycle use, motorized travel off of the trail is prohibited.

The lower one third of the area includes steep oak brush canyons. Cross country travel is difficult.

The difficulty of access makes this area remote.

Solitude: Summer use of the area is light because there are no attractions for the summer user. Opportunities to experience solitude are present. This opportunities are lessened during the fall big game seasons, when use increases.

Special Features: There are no identified special features within the Currant Creek vicinity.

Manageability/Boundaries: The Currant Creek area contains approximately 8000 acres. Its size and shape allow it to be managed in its present condition.

Special Places/Special Activities: The DOW considers this area important wildlife habitat. Its location on the south side of the Grand Mesa makes its wildlife value more important.

There is public interest is keeping this area the way it is.

One outfitter is permitted within this area. The outfitter utilizes a camp located on the Forest as the base of his operation.

Cunningham Creek

Location: Cunningham Creek is located in the southeast corner of the Priest Mountain Roadless Area. On the south, it is bordered by the Nation Forest boundary with private land. To the east, it avoids the Stevens Gulch Road FDR 701. To the north and west it follows the hydrologic divides between Cunningham Creek and West Hubbard Creek and Leroux Creek.

Natural Integrity: Natural processes here have been affected by the various improvements that have been constructed in the area. These include the Overland Ditch, FDR 703, FDR 486, the Betty Park Road, Holy Terror Reservoir, and the Pitkin Mesa Pipeline.

Proposed timber sales, for which there are approved NEPA documents, will further alter the natural processes below the Overland Ditch.

Apparent Naturalness: Once away from the constructed facilities described under Natural Integrity, the area appears natural. Proposed timber sales will alter this appearance.

Remoteness: The Cunningham Creek area is not remote. It is bordered by the Stevens Gulch Road FDR 701 and is accessed by three system roads. The area is open to motorized travel off roads and trails.

Solitude: There is little opportunity for experiencing solitude within this area.

Special Features: FDR 703 leads to the Shoneman Ditch Cabin, which is under special use permit to the Overland Ditch Company.

Manageability/Boundaries: Roads and other improvements cross through and penetrate the area, and have removed its roadless character. It is not manageable as roadless.

Special Places/Special Activities: The Pitkin Mesa Pipeline transports potable water from a series of springs to a subdivision on Pitkin Mesa. This pipeline parallels FDR 846. The springs are located approximately 1/4 mile north of the Overland Ditch.

Priest Mountain

Location: Priest Mountain is located at the head of Leroux Creek. Its southern boundary avoids the roads and development around Dog Fish, Doughty, Bailey, and Hanson Reservoirs. It is separated from Upper Leon Creek by the hydrologic divide that forms the Delta/Mesa County line. It is separated from Currant Creek by the corridor surrounding the Green Mountain Trail. The hydrologic divide extending from Crater Peak to the County line forms its remaining boundary.

Natural Integrity: Natural processes are in place and continuing.

Apparent Naturalness: The area appears natural.

Remoteness: Portions of Priest Mountain are near the developments of Doughty, Dog Fish and Goodenough Reservoirs. These facilities are serviced by roads open to public use and are not remote.

Other portions of this subdivision of the larger Priest Mountain Roadless Area are contiguous with Upper Cow Creek (an area managed for Semi-primitive Non-motorized Recreation), and the Flat Tops. These areas are more remote. The portion of Priest Mountain closest to these other areas shares these remote characteristics.

Solitude: The activities around the reservoirs and roads described under remoteness, limit the opportunities for experiencing solitude. In the same way that the portions of the area contiguous with Upper Cow Creek and the Flat Tops are more remote, the opportunities for solitude are greater in areas contiguous with Upper Cow Creek and the Flat Tops.

Trails 720 and 730 pass through the area and are open to motorized trail vehicles. Opportunities for solitude are lessened around these trail corridors.

Special Features: There are no identified special features.

Manageability/Boundaries: The boundary separating this portion of the Roadless Area from the developments in the remainder of Leroux Creek does not follow any geographic feature and is not recognizable on the ground. Priest Mountain is approximately 7000 acres. Its shape hampers its manageability for its roadless character. This portion of the Roadless Area is only one half mile wide in one location .

Other boundaries are contiguous with portions of the Roadless Area that retain their roadless character over large blocks of land. When combined with these other areas, Priest Mountain becomes manageable as roadless.

A corridor along the Green Mountain Trail separates Priest Mountain from Cunningham Creek. With both Priest Mountain and Cunningham Creek manageable for their roadless character, this corridor becomes suitable for the same management.

Special Places/Special Activities: None identified.

Hubbard Creek

Location: The Hubbard Creek portion of the Roadless Area includes the drainages of West, Middle, and Main Hubbard Creeks and Elk Creek. It is bordered on the the North by the Overland Reservoir, to the east by the Stevens Gulch Road, to the south by the Cunningham Creek area previously described.

This portion of the Priest Mountain Roadless Area is bisected by the Overland Ditch, which runs north to south through the area.

Natural Integrity: The area has been affected by the Overland Ditch and the construction of the new Stevens Gulch Road. A series of timber sales are planned for the area east of the Overland Ditch. These sales include: Hubbard 2, 1993, 5 MMBF; Cow 2, 1996, 3.2 MMBF; Elk 2, after 1997, no volume estimate. These timber sales were described in the Stevens Gulch Road and Related Timber Sales EIS (EIS 02-04-85-02) and Record of Decision, dated 9/12/86. These timber sales and their related roads will disrupt the natural processes within their boundaries.

Apparent Naturalness: Except for the construction of the Overland Ditch through the center of the area, it appears natural. The Stevens Gulch Road and powerline, running along the eastern edge of the area, do not appear natural. Planned timber sales and road construction will disrupt the natural appearance of the area east of the Overland Ditch.

Remoteness: Much of the area is not remote. There is road access along the east boundary of the area, and to Overland Reservoir, on the north. These roads have their greatest influence east of the Overland Ditch. West of the ditch the area is more remote, sharing the characteristics of the contiguous Cow Creek area, to the west.

Solitude: As with remoteness, the sense of solitude ranges from virtually none adjacent to the Stevens Gulch Road and Overland Reservoir to much higher opportunities for experiencing solitude adjacent to the Cow Creek Area. The sense of solitude is greater west of the Overland Ditch.

Special Features: There are no identified special features.

Manageability/Boundaries: The area east of the Overland Ditch will be affected by proposed timber sales and will loose its roadless character. Timber sales will be confined to this portion of the area and will not affect the area west of the ditch. This portion of Hubbard Creek will retain its roadless character.

Special Places/Special Activities: To the members of this Hubbard Park Subdivision, located in the vicinity of Hubbard Creek, the retention of the area's roadless character is desirable.

Upper Cow Creek

Location: Located west of the Overland Reservoir, this area contains Crater Lake and the headwaters of Cow Creek. It coincides with the 3A Management area. It is contiguous with the Hubbard Creek area, Priest Mountain area, Upper Leon Creek area and West Muddy area.

Natural Integrity: Natural processes are intact and continuing.

Apparent Naturalness: The area extends down Cow Creek to Overland Reservoir, the reservoir being outside the Roadless Area. The vicinity of the reservoir does not appear natural. However, within this portion of the Roadless Area the appearance is natural.

Remoteness: Adjacent to Overland Reservoir the area is not remote. The area becomes more remote further away from the reservoir. The area provides a Semi-primitive Non-motorized recreation setting. Except for snowmobiles operating on snow, it is closed to motor vehicles operating off designated routes. Since there are no designated open routes, the area is essentially closed to motor vehicles.

Solitude: The area offers a moderate level of opportunities for solitude. The feeling of solitude is less near Overland Reservoir. It is also less during the big game seasons when use increases.

Special Features: There are no identified special features.

Manageability/Boundaries: The 3A management area occupies 4800 acres. It is contiguous with other segments of the Priest Mountain Roadless Area that also retain their roadless attributes. It is manageable for retention of its roadless character.

Special Places/Special Activities: No special places or activities identified.

West Muddy

Location: The West Muddy area contains the headwaters of Peter, Dyke and West Muddy Creeks. It is northwest of Overland Reservoir and shares a boundary with the 3A Management area in Upper Cow Creek. It also shares a boundary with the Flat Tops portion of this Roadless Area.

Natural Integrity: Natural processes are intact and continuing. Though suitable timber is identified within the area no timber sales have occurred. The area is within the 7A Wood Fiber Production management area.

Apparent Naturalness: The area appears natural.

Remoteness: The West Muddy area by itself, is not remote. It is two miles wide and bordered by Overland Reservoir. FDR's 705 and 265 provide vehicle access near the area.

The west boundary of the area is common with the Flat Tops and Upper Cow Creek. This is where the West Muddy area is most remote. When viewed as part of Flat Tops and Upper Cow Creek (as it would be by a cross country traveler entering it from the west) the nearby road access would be unnoticed and the area would feel remote.

Solitude: Around the Overland Reservoir and the nearby roads, opportunities for solitude are limited. Adjacent to the Flat Tops and Upper Cow Creek opportunities for solitude are greater.

Special Features: None identified.

Manageability/Boundaries: Because of its size and shape, West Muddy by itself is not manageable as roadless. If managed as an extension of the Flat Tops and Upper Cow Creek, it becomes manageable as roadless.

Special Places/Special Activities: None identified.

Flat Tops

Location: From north to south, the Flat Tops area extends from the National Forest boundary near Vega Reservoir, to the hydrologic divide that forms the Delta/Mesa County line. From east to west, it extends from FDR's 265, 263, and 266 to FDR 280, along Leon Creek.

Natural Integrity: Most of the area retains its natural integrity. Constructed improvements within the area include Monument No. 1 and No. 2 Reservoirs, their associated ditches and approximately 1/2 mile of FDR 263. There are also four trails open to motorized use, within the area.

Apparent Naturalness: Away from the constructed improvements the area appears natural.

Remoteness: Much of the area is remote. Portions of the area closest to the bordering roads and the National Forest Boundary are less remote.

The majority of the area restricts motorized vehicles to trails (515, 517, 518, and 730).

Solitude: Even at the current level of motorized trail use, the area provides opportunities for experiencing solitude. Opportunities for experiencing solitude are less, adjacent to the nearby roads.

Special Features: The Flat Tops contains an area speculated to be an old wildfire that eliminated enough tree cover to elevate the water table. Now the elevated water table prevents the reestablishment of trees in low-lying areas. Trees have only become established on dryer mounds scattered throughout the area.

Good fishing is found in Monument Creek and the Monument Reservoirs.

Manageability/Boundaries: The area is large enough to be managed for its roadless qualities. The portion of the area north of the Silver Spruce Trail is not manageable for its roadless qualities. Also not manageable for its roadless character is that portion of the area affected by FDR 256.

Special Places/Special Activities: The area is popular with motorized trail rides, horseback riders, and wildlife photographers. Horse use increases during the hunting seasons. It is crossed by the Sunlight-Powderhorn snowmobile route.

Bronco Knob

Location: Bronco Knob is adjacent to the Flat Tops. It is bordered by FDR's 263, 265, and the Delta/Mesa County line.

Natural Integrity: The area retains its natural integrity. The proposed Monument timber sale, previously mentioned would disrupt the areas natural processes.

Apparent Naturalness: The area appears natural.

Remoteness: Bronco Knob itself, and the nearby Buzzard Park are remote. Access is difficult. Though the area is open to off road travel, it is heavily timbered, limiting cross country motorized access. Other portions of the area adjacent to the access roads are not remote.

Solitude: Opportunities for experiencing solitude are greatest near the adjacent Flat Tops area. Bronco Knob and Buzzard Park are in this location. Adjacent to FDR's 263 and 265 opportunities are less.

Special Features: None identified.

Manageability/Boundaries: As an extension of the Flat Tops the area is manageable for its roadless character.

Special Places/Special Activities: Important summer elk habitat.

Upper Leon Creek

Location: Upper Leon Creek is located west of the Flat Tops, in the area surrounding Hunter Reservoir. Its west boundary avoids FDR 127 and Colby Horse Park Reservoir.

Natural Integrity: The area's natural processes are intact and continuing. They have been disrupted only in the immediate vicinity of Hunter Reservoir and FDR 280.

Apparent Naturalness: Away from the road and reservoir the area appears natural.

Remoteness: The area is not remote. FDR 280 penetrates through the middle of the area.

Solitude: Opportunities to experience solitude are limited, due to the activity that takes place along FDR's 127 and 280.

Special Features: None identified

Manageability/Boundaries: The shape and size of the area, coupled with the presence of roads within and immediately to the west, make the area unmanageable as roadless.

Special Places/Special Activities: Attraction is Leon Creek and open valley vistas.

Roadless Area 192 - Salt Creek

Size and Location: As inventoried in RARE II, the Salt Creek Roadless Area was approximately 11,300 acres. All of the Roadless Area is within the Forest and within the analysis area.

Recent inventory data suggest that the area remaining roadless is only 8700 acres (Collbran Ranger District RIS data).

The area, located 6 miles southeast of Collbran, is bounded on the north and west by BLM and private lands. The south boundary avoids FDR 279. The east boundary avoids the Park Creek Road FDR 262. The Park Creek Road separates the Salt Creek Roadless Area from the Priest Mountain Roadless Area, to the east.

The area received a non-wilderness recommendation as the result of RARE II. None of the area has been designated Wilderness.

Oil and Gas Leasing: There are existing leases occupying approximately 4700 acres within the Roadless Area. There are two producing gas wells within the area, both near the external boundary: One in the northeast corner, adjacent to the Park Creek Road; the other is along the Forest boundary near East Salt Creek. A third producing well is within 100 feet of the Roadless Area near the head of Oak Creek. There are no pending APD's within the area.

The potential for oil and gas within the area is high.

Suitable Timber: The Forest Plan identifies suitable timber scheduled for harvest during the next decade. Suitable timber is identified on a total of 3900 acres. Approximately 200 acres of economically not suitable timber is also identified.

Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

The timber sales tentatively scheduled for the area include Grove Creek (FY 93), Valley View (FY 93), and Sheep Flats (FY 94). An EIS is being prepared for these timber sales.

Management Direction: The Forest Plan Management Areas included within the Roadless Area are: 5A Big Game Winter Range, 6B Livestock Grazing, and 7A Timber Production.

Natural Integrity: The extreme north edge of the area drops down steep slopes to the Forest boundary. This portion of the area has retained its natural integrity. The steep slope dropping into Leon Creek has also retained its natural integrity.

There are numerous non-system travelways within the area that have disrupted the natural integrity of meadows found in the remainder of the area. The Anderson Ditch extends from the Anderson Brothers Reservoir and is paralleled by a road open to public use.

Apparent Naturalness: The north face of the area and the slope into Leon Creek appear natural.

Because of the number of non-system routes within the area's meadows, the remainder of the area does not appear natural.

Remoteness: The Park Creek Road FDR 262 was improved by Exxon for access to a well near Monument Creek. That portion of the Roadless Area closest to this road (within Leon Creek and adjacent to the road) has lost its remoteness.

The north face of the area remains difficult to travel in, but its remoteness is limited due to the motorized use by ATV's, jeeps and trucks coming into the Roadless Area from the south. Most of the area is easily accessed by vehicle. When dry, the area is accessible by two wheel drive.

As a result, the area is not remote.

Solitude: With the easy access, most of the area contains little opportunity for solitude. As with other areas, use is greatest and solitude the least during the fall big game seasons.

Special Features: Proposed Sheep Flats and Grove Creek archaeological districts along the Sheep Flats Road FDR 279 encompass 248 and 89 acres, respectively. Historic and prehistoric sites have been found here that extend into the Roadless Area.

Manageability/Boundaries: While portions of the Roadless Area, such as the north face and Leon Creek, retain some of their roadless character, the majority of the area is not manageable as roadless.

Special Places/Special Activities: The north face of the area and Leon Creek are the special places of this Roadless Area.

Roadless Area 193 - Battlement Mesa

Size and Location: As inventoried in RARE II, the Battlement Mesa Area was approximately 71,000 acres. This included 34,000 acres on the White River National Forest and 37,000 acres on this Forest.

All of the Roadless Area on the Forest is within the analysis area.

The area is located 40 miles north of Collbran. The Forest's portion of the Roadless Area is bounded on the south by BLM and private lands, and on the north by the Forest boundary with the White River National Forest.

The area is long and narrow. East to west it is approximately 24 miles long. It ranges from 1 mile to 5 miles wide.

The area received a non-wilderness recommendation as the result of RARE II. None of the area has been designated Wilderness.

The area can be divided into two segments. The Sunnyside segment includes the western half of the area. The Battlement Mesa segment includes the eastern half.

Oil and Gas Leasing: There are existing leases occupying approximately 9,970 acres within the Forest's portion of the Roadless Area. No drilling has occurred in the Sunnyside portion of the area. Drilling has occurred on private land adjacent to the Battlement Mesa area. (Producing gas wells are located on BLM lands west of Sunnyside, on lands adjacent to the White River National Forest portion of the Roadless Area, and along the Plateau Creek Valley, in which the town of Collbran is located.)

The potential for oil and gas within the area is high.

Suitable Timber: The Forest Plan identifies no suitable timber in the Sunnyside area. The Battlement Mesa portion include 9200 acres of economically not suitable aspen.

Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

Management Direction: The Forest Plan Management Areas included within the Sunnyside area are: 4B Wildlife Habitat Management and 5A Big Game Winter Range. The Battlement Mesa area includes 5A Big Game Winter Range and 6B Livestock Grazing.

Natural Integrity: In the Sunnyside area, natural processes are intact and continuing.

The Battlement Mesa area has received extensive controlled burning to increase big game and livestock forage. This burning has imitated natural processes, but is the result of human intervention. McCurry Reservoir and numerous irrigation systems are located in the Battlement Mesa area. Natural processes have been modified.

Apparent Naturalness: The Sunnyside area appears natural.

The Battlement Mesa area appears natural to a slightly lesser degree. Irrigation systems and the system of open trails detract from the natural appearance, but once away from these modifications the natural appearance returns.

Remoteness: The Sunnyside area is very steep and inaccessible. Travel is difficult even on horseback. A person traveling on foot, struggling into the area, has a feeling that it is quite remote.

The Battlement Mesa area is also remote, though it contains a trail system open to motorized use (ATV's and motorcycles), travel off the trail system is difficult. Motorized travel off of the trail system is prohibited.

There is limited access to either area. FDR 275 reaches the area and marks the dividing point between the Sunnyside and Battlement Mesa segments. FDR 272 reaches the middle of the Battlement Mesa segment. FDR 271, a four wheel drive road, reaches the east end of the Battlement Mesa segment. The Sunnyside Road, also a rough four wheel drive route, reaches the west end of the Sunnyside segment. These access points are interconnected within the Roadless Area, except for the Sunnyside Road, which has no connection.

Solitude: A user of the Sunnyside area will experience solitude.

The sense of solitude will be less in the Battlement Mesa area. During the summer it will still be possible to experience solitude. During the fall big game seasons, this sense of solitude will be greatly diminished during periods of peak use.

Special Features: An isolated herd of bighorn sheep is found in the Sunnyside area. The Battlement Mesa area is also important habitat for mule deer and elk.

The geology of the Sunnyside area is an interesting feature.

Manageability/Boundaries: Because of the limited public access , the ruggedness of the area and the difficulty of travel within the area the area is manageable for its roadless qualities.

Special Places/Special Activities: The area contains important wildlife habitat. The water transported from the area is of vital importance to the adjacent private land owners who rely on it for irrigation. It is also an area of known oil and gas potential, with the Debeque gas field lying to the west and numerous producing gas wells to the north along the Colorado River/I 70 corridor.

Roadless Area 194 - Nick Mountain

Size and Location: As inventoried in RARE II, the Nick Mountain Roadless Area is approximately 11,000 acres. All of the Roadless Area is within the Forest and within the analysis area.

The area is located 10 miles southwest of Collbran. The Roadless Area is bounded on the north and west by BLM and private lands. The southern boundary avoids FDR 254 and other developments near Twin Basin Reservoir and Bull Basin Reservoir No. 2. The east boundary is near the penstock that transports water from various reservoirs to the Bureau of Reclamation's Collbran Project.

The area received a non-wilderness recommendation as the result of RARE II. None of the area has been designated Wilderness.

Oil and Gas Leasing: There are existing leases occupying approximately 3720 acres within the Roadless Area. No drilling has occurred in the Roadless Area.

The potential for oil and gas within the area is high.

Suitable Timber: The Forest Plan identifies suitable timber scheduled for harvest during the next decade. Suitable conifer is identified on 1770 acres. Approximately 400 acres of economically not suitable and 1400 acres not suitable due to visual sensitivity are also identified.

Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

A portion of the Long Slough timber sale (scheduled for 1995) extends into the Roadless Area from Long Slough and Twin Basin Reservoir.

Management Direction: The Forest Plan Management Areas included within the Roadless Area are: 4B Wildlife Habitat Management, 5A Big Game Winter Range, and 6B Livestock Grazing.

A special order, not shown on the current Grand Mesa Travel Map, closes the western half of the area to motorized use.

Natural Integrity: Several thousand acres near Nick Mountain itself have been controlled burned for wildlife habitat improvement.

Crum Reservoir is man made. The operator of Crum Reservoir has motorized access to the reservoir from the north. Other irrigation systems extend into the area from Twin Basin Reservoir, Coon Creek, Water Dog Reservoir, and the Bull Reservoirs. A ditch comes out of Cottonwood Creek between Nick and Bald Mountains and runs north for approximately 1/4 mile to the Forest boundary.

An abandoned reservoir is located in section 10 southeast of Nick Mountain.

A penstock, road and 12.5 KV powerline form the east edge of the Roadless Area.

These activities have modified natural processes in their immediate area. Away from these influences, natural processes are intact and continuing.

Apparent Naturalness: Away from the constructed improvements described under Natural Integrity, the area appears natural.

Remoteness: Travel is difficult within the area. There are few trails. The west half of the area is closed to motorized vehicles both on and off roads.

Access to the area from the north is difficult. There is no public access across the private land. Cross country access through the BLM is difficult.

The area feels remote.

Solitude: Summer recreation use is low, but the sense of solitude is tempered by use that occurs in the vicinity of FDR 254 and the reservoirs to the south, and by the range permittees and water users within the area. There is little to attract summer recreation users within the Roadless Area.

The sense of solitude is less during the fall big game seasons. The area is popular with hunters. Daily encounters during the hunting season could exceed 12 per day. Hunting camps are concentrated around the edge of the area. Some interior camps are accessed with horses or jeeps from the south.

Special Features: There are no special features within the area.

Manageability/Boundaries: The southern boundary of the Roadless Area is indistinct. The other boundaries are well defined. It is possible to manage the area as roadless, but areas closer to the

southern edge will have fewer roadless characteristics (less solitude, less remoteness) due to the improvements, access, timber sales, and level of activity.

Special Places/Special Activities: The water transported in the Bureau of Reclamation's penstock is used to generate power and is then sold to the Ute Water Conservation District.

Roadless Area 195 - Kannah Creek

Size and Location: As inventoried in RARE II, the Kannah Creek Roadless Area was approximately 34,600 acres. The Roadless Area is entirely on the Forest. Though the area received a Wilderness recommendation as a result of RARE II, none of the Roadless Area has been designated Wilderness.

All of the Roadless Area is within the analysis area.

The area is located on the west end of the Grand Mesa. To the north it is bounded by the Lands End Road FDR 100. To the west and south, its boundary is the National Forest boundary. The east boundary roughly parallels the rim of Grand Mesa. It contains the headwaters of the Kannah Creek.

A very small portion of the south boundary is shared with the BLM Adobe Badlands WSA. The Adobe Badlands WSA received a non-Wilderness recommendation from the BLM.

Oil and Gas Leasing: There are existing oil and gas leases within the Roadless Area. These leases occupy approximately 990 acres. No drilling has occurred on these leases.

The potential for oil and gas within the area is high.

Suitable Timber: The Forest Plan identifies 745 acres of suitable conifer timber within this area. Another 4,170 acres are not suitable because of sensitivity. The Forest Plan indicates that a timber sale is planned along the eastern boundary of the Roadless Area during the next decade. The Flowing Park timber sale extended into the Roadless Area in the area southwest of Flowing Park Reservoir.

Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

Management Direction: The Forest Plan Management Areas included within the area are: 4B Wildlife Habitat Management, 5A Big Game Winter Range, 6B Livestock Grazing, and 7A Wood Fiber Production.

The Mesa Point Electronic Site is located in the southwest corner of the Roadless Area (T13S, R97W, 6thPM, Section 34). There are four transmitters at the site.

The area is open to grazing.

Natural Integrity: Natural processes have been modified in the vicinity of the Flowing Park timber sale. In other areas within the Roadless Area natural processes are intact and continuing.

Apparent Naturalness: Once away from the Flowing Park timber sale, the Electronic Site and the trails described under Remoteness, the area appears natural.

Remoteness: The area is accessed by a system of foot and horse trails. The current travel management plan for the area shows the majority of the area, including these trails, closed to motorized use. That portion of the area east of the Grand Mesa rim, is open to snowmobiles operating on snow. There are no roads open to public use within the area, though the boundary of the area comes very close to the Lands End Road. Topography limits access into the area from the Lands End Road.

The Mesa Point Electronic Site is accessed by a road extending onto the Forest from adjacent BLM lands. This road is located in Wells Gulch. A buried powerline servicing the Electronic Site follows the road corridor.

Away from the influence of the Lands End Road, the Mesa Point Electronic Site and the activity around Flowing Park and Chambers Reservoirs, the area feels remote. This remoteness is greatest below the Grand Mesa rim and in the Kannah Creek basin.

Solitude: The trail system within the area receives use during the summer season as well as the fall big game seasons. Encounters with non-motorized users occur along this trail system but are not at a level that detracts from the sense of solitude experienced within the area. The sense of solitude is greatest within the Kannah Creek Basin. East of the Grand Mesa rim, near Flowing Park and Chambers Reservoirs, this feeling of solitude is lessened. This sense of solitude is also lessened at the Mesa Point Electronic Site.

Special Features: Kannah Creek provides municipal water for the City of Grand Junction.

Manageability/Boundaries: The rim of the Grand Mesa provides an easily defined boundary and physical barrier separating the core of the Roadless Area from the Flowing Park/Chambers Reservoir area.

Special Places/Special Activities: Public interest in maintaining the roadless character of the Kannah Creek basin is high.

Spectacular views into the basin and the valley beyond are possible from along the Grand Mesa rim.

Roadless Area 196 - West Elk

Size and Location: As inventoried in RARE II, the West Elk Roadless Area was approximately 209,000 acres. This included approximately 87,000 acres that received a non-wilderness recommendation and 122,000 acres that received a Wilderness recommendation.

All of the Roadless Area was on the Forest.

P. L. 96-560 (12/22/80) added to the existing Wilderness from lands included in the RARE II inventory. West Elk Wilderness now totals approximately 176,000 acres.

Of the remaining inventoried Roadless Area approximately 28,000 acres are within the analysis area. This remaining area is split into six separate segments, located either along the Kebler Pass Road, on Snowshoe Mesa, on Coal Creek Mesa, north of Mount Lamborn, or southwest of Landsend Peak. (See Figure III-8a.)

Oil and Gas Leasing: There are existing oil and gas leases occupying approximately 705 acres within the Roadless Area. One of these leases is in the Snowshoe Mesa area. The other in the Mount Lamborn area.

The potential for oil and gas within the area is high on 17,240 acres, moderate on 10,960 acres, and no known potential on 95 acres.

Suitable Timber: The Forest Plan identifies no suitable timber acres within the Roadless Area. Approximately 1800 acres are identified as unsuitable because of visual sensitivity.

Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

Management Direction: The Forest Plan Management Areas included within the Roadless Area in the analysis area are: 3A Semi-primitive Non-motorized Recreation, 4B Wildlife Habitat for Indicator Species, 5A Big Game Winter Range, and 6B Livestock grazing.

Approximately 1600 acres are within the 3A management area.

All of the area is open to grazing.

Natural Integrity: The west half of the Coal Mesa area is leased for coal and is underlain by active mining. The east half of this area is included in an active coal exploration permit. Dozens of exploratory holes have been drilled. Subsidence of approximately one foot has occurred in the north west corner of this area. FDR 711 and its spurs are open, within the area. These factors combine to disrupt the natural integrity of the Coal Mesa area.

Natural processes in the remainder of the Roadless Area within the analysis area are intact and continuing.

Apparent Naturalness: The Coal Mesa area appears to be modified by human influence. The remaining areas appear natural.

Remoteness: The most remote portion of the Roadless Area is within the 3A Management Area. Other areas exhibit different levels of remoteness.

Areas adjacent to the West Elk Wilderness are more remote. Areas adjacent to the human activity that surrounds the Wilderness are less remote. A user leaving the Wilderness who has not yet encountered the human influences that surround the Wilderness may still experience a feeling of remoteness. A user leaving the human activity behind and traveling into the Wilderness my not have the same feeling of remoteness when in the same location.

Because of the road system in the Coal Creek Mesa area, this segment is not remote.

Solitude: There is little opportunity for solitude within the Coal Creek Mesa area because of the roads associated with coal exploration.

The area southeast of Lost Lake, near Kebler Pass, is crossed by a system of trails that connect Lost Lake, Dollar Lake and Horse Ranch Park. This is a popular area where the number of encounters will limit the sense of solitude.

Like the feeling of remoteness, the sense of solitude will vary throughout the remainder of the area. The best opportunities for solitude have already been included within the West Elk Wilderness or within the 3A Management Area. Locations near the Wilderness boundary or the 3A Management Area will have greater opportunities for solitude than areas adjacent to the surrounding roads.

The sense of solitude will also vary with the user's frame of reference. A user entering the area from an urban environment will have a different sense of solitude than a user returning for several days of no encounters within the Wilderness.

Special Features: The Kebler Pass Scenic Byway Corridor is adjacent to portions of the area. The visual quality of the Roadless Area as viewed from the byway is important.

Landsend Peak and Mount Lamborn are landmarks of special importance to residents of the Paonia, Hotchkiss and Crawford areas.

Wiley Springs, in the Landsend segment, provides water to the community of Crawford.

Manageability/Boundaries: The remaining Roadless Area is broken into small segments,by roads. The Wilderness and the 3A Management area contain the remnants most manageable for roadlessness. The segments adjacent to the Wilderness boundary retain at least some of their manageability as roadless. The Wilderness acts as a unifying tie between these small segments.

Special Places/Special Activities: Scenic views along the Kebler Pass Road, especially those involving stands of aspen, are special to the public.

Roadless Area 200 - Whetstone Mountain

Size and Location: As inventoried in RARE II, the Whetstone Mountain Roadless Area was approximately 15,400 acres. All of the Roadless Area is on the Forest. None of the Roadless Area has been designated Wilderness. Approximately 13,100 acres of the Roadless Area are within the analysis area.

The Roadless Area is bordered on the north by the Kebler Pass Road and the National Forest boundary, two miles south of Crested Butte. The east boundary is Squaw Gulch. The west boundary avoids the Ohio Pass and Splain Gulch Roads. The southern boundary follows the Forest boundary and avoids roads leading to private land within and adjacent to the Roadless Area.

Oil and Gas Leasing: There is one existing oil and gas lease within the Roadless Area, occupying approximately 1900 acres. There has been no drilling in the Roadless Area.

The potential for oil and gas within the area is low and no known.

Suitable Timber: The Forest Plan identifies approximately 2400 acres of suitable timber within the portion of the Roadless Area in the analysis area. Another 6000 acres not suitable because of economics are also identified. Seventy acres are identified as not suitable because of visual sensitivity. Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

There are no timber sales planned during the next decade.

Management Direction: The Forest Plan Management Areas in the portion of the Roadless Area within the analysis area include: 2A Semi-primitive Motorized Recreation, 6B Livestock Grazing and 7A Wood Fiber Production.

The area is open to grazing.

Natural Integrity: There have been no timber sales, controlled burns or other vegetative treatments within the area. The area is crossed by both system and non-system roads and trails. The Bulkley Mine, just northeast of the area, was mined for gold and other hard rock minerals. Other mining remains may be found within the area. Away from these disturbances natural processes are in place and continuing.

Apparent Naturalness: Once away from roads that border the area and the travel routes within it, the area appears natural.

Remoteness: The terrain is steep and rugged. Portions of the area are heavily timbered. Cross country travel between the Green Lake area (over Mt. Axtel and Gibson Ridge) and the remainder of the Roadless Area is difficult. The area surrounding Whetstone Mountain itself, is difficult to access.

These factors create a feeling of remoteness in parts of the area. This remoteness is diminished in other portions of the area because of the system and non-system travel routes surrounding and within the Roadless Area.

The trail leading to Carbon Peak is not on the transportation system but is traveled by mountain bicycles. FDR 737 provides access to 160 acres of private land located roughly in the center of the area. FDR 563, which borders the southeastern portion of the area, has been improved to a log truck standard for timber removal from private land outside the Roadless Area. The Kebler Pass and Ohio Pass Roads are all weather passenger car roads. FDR 730.1D penetrates into the area 1 mile, from the Ohio Pass Road. From here on it becomes Trail 436 and connects with FDR 737. The route extending southwest from the Bulkley Mine is not on the transportation system. The route to Green Lake from the Kebler Pass Road, is passable to 4x4 trucks for most of its length. A non-system route ties Green Lake to BLM and private lands. This route is popular with mountain bicyclists.

With is variety of access routes surrounding and penetrating the Roadless Area, it is not remote.

Solitude: The area offers mixed opportunities for solitude.

Green Lake, with its access route and popularity with fishermen, offers little opportunity for solitude. The other extreme within the Roadless Area is Whetstone Mountain. It's distance from a public access point, the lack of public access to Highway 135, and the difficulty of cross country travel from Green Lake, permit this portion of the Roadless Area to provide good opportunities for experiencing solitude.

Solitude within the remainder of the area is tempered by the presence of travel routes and the activity on them. Opportunities for solitude decrease during the fall big game season as hunting camps are placed along the travel routes.

Overall the area offers a moderate opportunity for solitude.

Special Features: The route of FDR 730.1D was at one time a railroad grade.

Manageability/Boundaries: The shape and size of the area permit its management as roadless. Roads within the area would have to be closed to manage the area in this way.

Special Places/Special Activities: Green Lake is popular for fishing.

The town of Crested Butte, located two miles northeast of the Roadless Area, is a focus point for mountain bicycling. The Roadless Area is popular for mountain biking.

Roadless Area 201 - Flat Top Mountain

Size and Location: As inventoried in RARE II, the Flat Top Mountain Roadless Area was approximately 19,800 acres. Only 110 acres of the Roadless Area is in the analysis area. None of the Roadless Area has been designated Wilderness.

The Roadless Area is broken into three segments by existing roads. The segment in the analysis area is bordered on the south by FDR 829. On the north it is bordered by private land inholdings and the road that accesses them. The west boundary of the segment is the National Forest boundary. The east boundary is formed in part by the Forest boundary.

The area is located 14 miles north of Gunnison and 9 miles east of the West Elk Wilderness.

Oil and Gas Leasing: There are no existing oil and gas leases within the Roadless Area.

The potential for oil and gas within the area is low and no known.

Suitable Timber: The Forest Plan identifies 60 acres of suitable timber within the portion of the Roadless Area within the analysis area. Another 35 acres not suitable because of economics, are also

identified. Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

There are no timber sales planned during the next decade.

Management Direction: The Forest Plan Management Areas within that portion of the Roadless Area within the analysis area include 2A Semi-primitive Motorized Recreation, 4B Wildlife Habitat Management and 6B Livestock Grazing.

The area is open to grazing.

Natural Integrity: Natural processes are in place and continuing.

Apparent Naturalness: Once away from roads that border the area to the south and north, and the subdivided private land, the area appears natural.

Remoteness: The area is not remote.

The area is approximately 1 mile wide and 4 miles long. The northeast corner of the area is the furthest removed from the roads described under Size and Location, but most of the area is within 1/2 mile of a road.

Solitude: The portion of the area within the analysis area is adjacent to a 2-wheel drive road accessing the private land to the north. To the south, FDR 829 is a 4-wheel drive road leading to Big Alkali Lake and a permitted cow camp. This area receives year round use that peaks during the fall big game seasons. Opportunities for solitude are limited.

Special Features: There are not special features within the Roadless Area.

Manageability/Boundaries: The RARE II area is broken into three segments. The shape, size and proximity of roads and private land subdivisions detract from the manageability of the segment within the analysis area as roadless.

Special Places/Special Activities: The area provides good elk summer range and is popular for elk hunting.

Roadless Area 241 - Roubideau

Size and Location: As inventoried in RARE II, the Roubideau Roadless Area was approximately 19,800 acres. The Roadless Area is entirely on the Forest. Though the Roadless Area received a Wilderness recommendation as a result of RARE II, none of the Roadless Area has been designated Wilderness.

Approximately 6,500 acres of the Roadless Area is within the analysis area.

The area is located 18 miles west of Montrose.

The north boundary of the Roadless Area is formed by the Forest boundary with lands administered by the BLM. These lands are within the BLM's Camel Back Wilderness Study Area. This study area has received a non-wilderness recommendation from the BLM. The east boundary avoids the nearby Transfer Road FDR 508 and Roatcap Road FDR 542. The south and west boundaries avoid other roads extending toward the Roadless Area from the Divide Road FDR 402.

Oil and Gas Leasing: There are no existing oil and gas leases within the Roadless Area. The potential for oil and gas within the area is high on 6435 acres, low on 50 acres.

The adjacent BLM Camel Back WSA is not available for oil and gas leasing until its status as a Wilderness Study Area is resolved.

Suitable Timber: The Forest Plan identifies suitable timber scheduled for harvest in the portion of the Roadless Area that is within the analysis area. Approximately 800 acres are suitable aspen. Another 600 acres are suitable conifer. Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

Management Direction: The Forest Plan Management Areas included within the Roadless Area are: 4B Wildlife Habitat, 4D Aspen Management, 5A Big Game Winter Range, 6B Livestock Grazing, and 7A Wood Fiber Production.

The area is open to grazing.

Natural Integrity: An ongoing program of controlled burning, done cooperatively with the Colorado Division of Wildlife, has burned several of the oak brush basins within the Roadless Area, including: Horseshoe Basin and East Basin. The Davis Point area has also been burned. This burning has sought to improve Big Game Winter Range by restoring fire to the area, mimicking natural processes.

In other portions of the Roadless Area, natural processes are in place and continuing.

One permitted irrigation system diverts water from the Roubideau Creek drainage, above the Roadless Area. This system diverts water only during the spring snow melt. Current amounts of diversion have no effect on the natural processes within Roubideau Creek.

Apparent Naturalness: Several trails within the Roadless Area, as well as some stock trails and low standard roads have been dozer constructed. The great majority of the Roadless Area is away from these facilities and appears natural.

Remoteness: The area is accessed by the Pool Creek, Roubideau, Transfer, Traver, and Ben Lowe Trails. These routes and the area off the trail system are open to motorized travel. Trail alignment and the surrounding terrain limit the amount of motorized use that occurs both on and off the trails. The Tabeguache Trail (a mountain bicycle route through the Forest which links together roads and trails) avoids the Roadless Area.

Full size vehicle access is possible into the fringes of the Roadless Area, but difficult into the area's basins. Foot and horse are the most frequent forms of access into the Roadless Area.

Due to the difficulty of access, the area remains remote. Locations within the canyon core of the Roadless Area along Roubideau Creek are the most remote.

Solitude: The canyon core receives little summer use. It is possible to visit the area and experience no encounters with others. The sense of solitude is great.

Hunting seasons increase the use of the area. Encounters are more frequent. The sense of solitude is less.

Special Features: On the Uncompahgre Plateau, the Roubideau Roadless Area is one of the most remote and difficult to access.

Manageability/Boundaries: The area is large enough to maintain its naturalness and remoteness. While portions of the Roadless Area boundary do not follow any distinct landform, once away from the fringe, steep sandstone slopes rim most of the area.

Special Places/Special Activities: The area has been included in several recent Wilderness proposals. Interest in making this area a Wilderness is high.

The one permitted outfitter operating in the area is keenly interested in making the area a Wilderness.

The area's remoteness, wildlife value, scenery, and solitude are important to those favoring Wilderness designation. As a Wilderness the area would include mid and lower elevation plant communities not well represented in existing higher elevation Wilderness.

Roadless Area 242 - Tabeguache

Size and Location: As inventoried in RARE II, the Tabeguache Roadless Area was approximately 10,200 acres. The Roadless Area is entirely on the Forest. Though the Roadless Area received a Wilderness recommendation as a result of RARE II, none of the Roadless Area has been designated Wilderness.

Approximately 8400 acres of the Roadless Area is within the analysis area.

The area is located 6-8 miles northeast of Nucla.

The west boundary of the Roadless Area is formed by the Forest boundary with lands administered by the Bureau of Land Management. These lands are within the BLM's Tabeguache Wilderness Study Area. Almost all of this study area (7748 acres) has received a Wilderness recommendation from the BLM.

On the National Forest, the boundary of the Roadless Area follows the rim of Tabeguache Creek and the North Fork of Tabeguache, while avoiding the main Delta-Nucla and Divide Roads. The boundary also avoids road in the Pinto Mesa, Copper King and Spruce Mountain areas.

The Tabeguache Roadless Area has been included in several Wilderness proposals. At least one of these proposals extended the area being considered for Wilderness beyond the boundary of the inventoried RARE II area, to include lands north and north east of Spruce Mountain. This proposed Wilderness boundary is shown on a map entitled, Tabeguache Wilderness Proposal, Map Date, February 1, 1992, contained within the project file.

Oil and Gas Leasing: There are four existing oil and gas leases within the Roadless Area occupying approximately 1000 acres.

Oil and gas potential in that portion of the Roadless Area within the analysis area is high.

The adjacent BLM Tabeguache WSA is not available for oil and gas leasing until its status as a Wilderness Study Area is resolved. If it becomes Wilderness it will not be available for leasing.

Suitable Timber: The Forest Plan identifies approximately 800 acres of suitable timber within the portion of the Roadless Area in the analysis area. Approximately 1000 acres are identified as not suitable because of visual sensitivity. Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

Management Direction: The Forest Plan Management Areas included within the Roadless Area are: 4B Wildlife Habitat, 5A Big Game Winter Range, 6B Livestock Grazing, 7A Wood Fiber Production, and 10A Research Natural Area.

The area is open to grazing.

Natural Integrity: Natural processes are in place and operating within the Roadless Area. There is little evidence of human induced change.

Outside of the Roadless Area, as defined by RARE II, but within the area proposed for Wilderness in the previously cited map dated February 1, 1992 is a series of clearcuts and their associated roads. Natural processes have been altered in this part of the Roadless Area.

Apparent Naturalness: Except within the vicinity of the timber sales just described, the area appears natural.

Remoteness: Access is limited. Travel is difficult. The area is remote.

The area is accessed by the Indian Trail 500. Motorized travel is allowed both on and off trails, but terrain and trail condition limits motorized use. The trail was difficult to find until it was recently maintained. Foot and horse are the typical modes of access.

Roads lead up to the Roadless Area boundary through private land below the National Forest, at The Meadows Ranch. These roads are not open to public use.

Once into the canyon the nearby roads such as those on Pinto Mesa, Copper King, and the Delta-Nucla Road do not detract from the areas remoteness. The exception to this feeling of remoteness is the area near the clearcuts north and east of Spruce Mountain.

Solitude: The canyon receives little summer use. It is possible to visit the area and experience no encounters with others. The sense of solitude is great. Some increase in summer use has been observed during the last year because people had heard of the Tabeguache Wilderness and wanted to find it.

Hunting seasons increase the use of the area, but only slightly.

Special Features: The proposed Tabeguache Research Natural Area (Management Area 10A) is within the Roadless Area.

Manageability/Boundaries: Though very narrow (only one mile wide in places), a well defined topographic boundary can be created around the Roadless Area. Especially in conjunction with the BLM lands proposed for Wilderness, below the National Forest. The area is manageable for its roadless qualities.

Special Places/Special Activities: Public interest in making this area Wilderness continues to be expressed. It continues to be included in Wilderness proposals before Congress. As Wilderness, it would contain vegetation types not well represented in current Colorado Wilderness area. It also would not be a headwaters Wilderness.

Roadless Area 243 - Kelso Mesa

Size and Location: As inventoried in RARE II, the Kelso Mesa Roadless Area was approximately 34,000 acres. The area received a non-wilderness recommendation. None of the Roadless Area has been designated Wilderness.

Approximately 1200 acres in the southwest corner of the Roadless Area are within the analysis area.

The area is located on the east side of the Uncompahgre Plateau, approximately 24 miles southwest of Delta.

Oil and Gas Leasing: There are no existing oil and gas leases within the Roadless Area.

There is no known potential for oil and gas within the area.

Suitable Timber: The Forest Plan identifies no suitable timber within that portion of the Roadless Area in the oil and gas analysis area. There are 945 acres currently not suitable because of economics, within the analysis area. Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

Management Direction: The Forest Plan Management Areas included within the area are 4B Wildlife Habitat and 6B Livestock Grazing.

Natural Integrity: Natural processes are in place and continuing throughout the Roadless Area.

There is little human induced change.

Apparent Naturalness: The area appears natural.

Remoteness: Access into the area is difficult. Private land in the vicinity of Middle Point blocks access into the area from the Divide Road. Private land southwest of Escalante Forks blocks access from the north. Access is difficult and although the area is open to motorized vehicle travel (both on and off roads and trails), most of the access into the area is by foot or horse. The area is remote.

Solitude: Use of the area is heaviest during the fall big game seasons. The sense of solitude is less then than during the summer season when there is little use within the area because of the lack of attractions.

Special Features: The lack of roads and the difficulty of access makes the area attractive to wildlife, which in turn attracts hunting use during the fall big game seasons. One permitted outfitter operates into the area from the private land near Middle Point. Elk hunting is good because of the remoteness and lack of access.

Manageability/Boundaries: The size, shape, and boundaries of the area make it possible to manage it to preserve its roadless character.

Special Places/Special Activities: No other area of this size with the remoteness and difficulty of access is found on the Uncompahgre Plateau. The other inventoried Roadless Areas on the Plateau are one third to two thirds this size.

Roadless Areas 246 - Campbell Point
247 - Johnson Creek

Size and Location: The Campbell Point and Johnson Creek Roadless Areas both lie on the west side of the Uncompahgre Plateau, approximately ten miles northeast of Uravan. They are separated by a narrow corridor surrounding FDR 411, the Campbell Point Road. Both Roadless Areas border the Forest boundary with BLM lands. They are similar enough to be discussed together.

As inventoried in RARE II, Campbell Point Roadless Area was approximately 11,300 acres. Only 395 acres of the Roadless Area are within the oil and gas analysis area. RARE II inventoried the Johnson Creek Roadless Area as 10,300 acres. Approximately 5,340 acres are within the analysis area.

Both areas received non-wilderness recommendations. Neither has been designated Wilderness.

Oil and Gas Leasing: There are no existing oil and gas leases within the Campbell Point Roadless Area. There are three leases within the Johnson Creek Roadless Area, occupying 1100 acres. There has been no ground disturbing activity within the Roadless Area on these leases.

The potential for oil and gas within the portion of the Campbell Point area in the analysis area, is moderate. The potential for the Johnson Creek area is moderate on 4245 acres and no known on 1090 acres.

Suitable Timber: Within the analysis area, the Forest Plan identifies no suitable timber within the Campbell Point area, and 70 acres of suitable aspen within the Johnson Creek area.

Table III-12 displays the number of acres by timber suitability type within the Roadless Area.

Management Direction: The Forest Plan Management Areas included in these two Roadless Areas are: 4B Wildlife Habitat for Indicator Species, 4D Aspen Management, 5A Big Game Winter Range, and 7A Timber Management. Both areas are open to grazing.

Natural Integrity: An area along the northeast edge of the Campbell Point Roadless Area was included in the completed Long Canyon timber sale. Long Canyon has also been included in a prescribed fire.

Within the Johnson Creek Roadless Area, Mesa Creek has been burned to improve wildlife forage.

Natural processes are intact and continuing in the remainder of both areas.

Apparent Naturalness: Once away from the timber activity near Long Canyon, the areas appear natural.

Remoteness: There are trails in each area. Terrain limits travel predominately to horse and foot. This is unlike the BLM lands below the Campbell Point Roadless Area, which are heavily roaded as a result of uranium exploration. The presence of this dense road system lessens the feeling of remoteness within the Campbell Point Roadless Area.

A portion of the Campbell Point Roadless Area is closed to motorized travel off of designated routes.

Solitude: There are no attractions within the areas to draw summer users. The areas are hot and dry. Summer use is light and the chance for solitude is great. Use increases during the fall big game seasons. Use of the areas is greater near their upper boundaries, where roads permit vehicle access close to the Roadless Areas, from the Divide Road.

Special Features: The most important feature of these Roadless Areas is the wildlife habitat that they provide. Mountain lion hunting is a potential activity within the areas. This is an activity that has only a limited occurrence on the Forest.

Vantage points within the areas can provide views into Utah and the La Sal Mountains, to the west.

Manageability/Boundaries: The two Roadless Areas are long and narrow (2 to 3 miles wide, 15 miles long) and lie between the roaded BLM land to the west, and roaded National Forest along the Divide Road to the east. The two areas are split by FDR 411.

The roads on the National Forest are confined to the flatter terrain to the east and do not descend the steep slopes into the Roadless Areas. In the absence of oil and gas leasing, it would be possible to continue their condition as roadless.

Special Places/Special Activities: No special places or activities have been identified in these Roadless Areas.

Research Natural Areas

There are approximately 655 acres of this environment within the analysis area. Figure III-9 is a reduced scale map showing the approximate location of these areas.

There are no established Research Natural Areas in the analysis area; however, a Tabeguache Research Natural Area, located nine miles north of Nucla, has been proposed. This 655 acre site contains ponderosa pine. Management prescription 10A is assigned to Research Natural Areas.

A Research Natural Area is a physical or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation may be utilized to maintain the unique feature that the Research Natural Area was established to protect (FSM 4063.05). In Research Natural Areas, the emphasis is on research, study, observations, monitoring and educational activities that are non-destructive and non-manipulative, and that maintain unmodified conditions.

At the time a research natural area is established, procedures for withdrawal from mineral entry and leasing will be initiated (FSM 4063.49, R2 Supplement No. 1).

Sensitive Areas

There are approximately 29,000 acres of this environment within the analysis area. Figure III-10 is a reduced scale map showing the approximate location of these areas.

Between the draft and final SEIS for the Amended Plan, the Forest evaluated all tentatively suited (for timber harvest) 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. One of the criteria in this evaluation included lands proposed for resource uses that precluded intensive land development, such as timber harvest. The lands identified in this category were called Sensitive Areas. Nine Sensitive Areas identified in the 1991 amended Forest Plan are in the analysis area. They are:

1. Kebler Pass area
2. Raggeds Bench area
3. Powderhorn Ski Area
4. Bull Reservoir area
5. Upper Hotel Lake/Crag Crest area
6. Kannah Creek area
7. Tabeguache area
8. Beaver Ponds/Eureka area
9. Carson Lake area

Retention VQO

There are approximately 7,800 acres of this environment within the analysis area. Figure III-11 is a reduced scale map showing the approximate location of these areas.

Retention VQO (visual quality objective) provides for management activities which are not visually evident to the casual forest visitor. Under Retention, activities may only repeat the form, line, color and

texture found in the natural landscape. Changes in the visual qualities of size, amount, intensity, direction, pattern, etc. of the natural landscape should not be evident. Management activities can take place, but their design must be such that landscape modification, such as the cutting of trees or the construction of a road would not be noticeable at first glance.

Major highways, high use area, and water bodies in areas where the landform, rock form, vegetation patterns, water forms, and lakes and streams have distinctive scenic qualities, are typically assigned a Retention VQO. In the analysis area, Retention VQO can be found along the Grand Mesa and West Elk Loop Byways, along the Crag Crest National Recreation Trail, in the Alexander Lodge and Granby Lakes areas, and in the cliff portions of the flanks of Grand Mesa. There is no Retention VQO mapped on the Uncompahgre Plateau portion of the analysis area.

Retention VQO and Low VAC

There are approximately 7,210 acres of this environment within the analysis area. Figure III-12 is a reduced scale map showing the approximate location of these areas.

These are areas of Retention VQO that also have a low visual absorption capability (VAC). Retention VQO is discussed above. An area may be assigned a Low VAC because of a combination of physical and biological, observer, or existing visual quality factors. An area of Low VAC could not be modified without that modification being obvious to the viewer.

The physical and biological factors considered in determining the VAC of a landscape includes: Slope, vegetative pattern variety, vegetative screening ability, vegetative regeneration potential, and the soil characteristics of productivity, color and erosion potential.

As the slope increases, the VAC decreases because it is more difficult to regenerate steep slopes, activities are more highly visible on steep slopes, and on steep slopes openings become more evident.

The greater the diversity or complexity of a landscape, the better it can accept modification without visual degradation, i.e., disturbance of a homogenous landscape stands out.

Increased density and height of vegetative cover increases the screening potential, and thus the VAC.

Lands that can revegetate rapidly will have a higher VAC. A dry, arid, compacted site would have a Low VAC because of its low regeneration potential.

On productive lands, scars will heal relatively fast. Where slopes are oversteepened, activity scars may never heal, due to constant soil movement. Lands with light colored soils are more noticeable when exposed during disturbance, and therefore would have a lower VAC than dark colored soils.

Observer related factors include: the distance the observer is from the disturbance, where the observer is in relation to the disturbance (both horizontally and vertically), the length of time the observer views the landscape, the speed of travel, and the number of times the observer can see the particular landscape from key viewpoints.

The existing visual quality refers to the absence or extent of modification which has already occurred, i.e., the naturalness of the landscape due to man's activities.

In the analysis area, the combination of Retention VQO and Low VAC occurs in scattered areas along major roads on Grand Mesa, and along the Kebler Pass road.

Scenic Byway Corridors

There are approximately 18,140 acres of this environment and 55 miles of byway roads within the analysis area. Figure III-13 is a reduced scale map showing the approximate location of these areas.

There are three (3) Scenic Byways that pass through and one (1) that is adjacent to the analysis area. The three Scenic Byways that pass through the analysis area are: 1) Grand Mesa Scenic and Historic Byway, 2) West Elk Loop Scenic and Historic Byway, and 3) Unaweep/Tabeguache Scenic and Historic Byway. The San Juan Skyway National Scenic Byway is adjacent to the analysis area.

Grand Mesa Scenic and Historic Byway

The 65 mile route across Grand Mesa was designated by the State of Colorado Transportation Commission as a State Scenic and Historic Byway on September 21, 1991 with the northern extension being added on February 20, 1992. It was also designated by Forest Service Chief Dale Robertson as a National Forest Scenic Byway in March 1992. Thirty four (34) miles of this route are within the analysis area. The byway (State Highway 65), extends from Interstate 70 on the northwest, through Plateau Creek Canyon, up onto the Grand Mesa and back down to the town of Cedaredge on the south. It includes a 13 mile spur out the Lands End Road to Lands End Observatory (Lands End Visitor Center). Grand Mesa is the "world's largest flat top mountain"; a place the Ute Indians call Thunder Mountain. It is in reality a massive forested mesa surrounded by semi-arid lowlands. It is a hidden oasis of more than 300 lakes and reservoirs, a garden of wildflower meadows and a forest of aspen and spruce. The area is rich in cultural resources, ranging from early ranching to the country's first Forest Ranger, Civilian Conservation Corps, and recreation use.

West Elk Loop Scenic and Historic Byway

The 205 mile route around the West Elk Wilderness and adjacent to the Raggeds Wilderness is proposed for National Forest Scenic Byway designation. It was designated by the State of Colorado Transportation Commission as a State Scenic and Historic Byway on September 21, 1991. Twenty (20) miles of this route are within the analysis area. The route passes through scenic river valleys, over mountain passes with far reaching vistas, down through river canyons and out onto open valley floors which abound with working cattle ranches and fruit orchards. In the fall, stately stands of aspen groves found on the mountain passes, provide a colorful contrast to the red hues of scrub oak in the lower terrain. Alpine meadows on McClure Pass and Kebler Pass abound with wildflowers during the summer months. Cultural resources along the way include Dominguez and Escalante exploration, coal mining, railroading, and ranching.

Unaweep/Tabeguache Scenic and Historic Byway

The 138 mile byway highlights western Colorado's canyon and ranch country. It was designated by the State of Colorado Transportation Commission as a State Scenic and Historic Byway on October 18, 1990. One mile of this route passes through the analysis area. This Byway traverses some spectacular sandstone canyon and arid ranch country of western Colorado. Cultural resources include Dominguez and Escalante exploration, uranium mining, ranching, and utopian town development.

San Juan Skyway National Scenic Byway

The 232 mile route through the San Juan Mountains of southwestern Colorado, including the historical section of the "Million Dollar Highway", was designated by Forest Service Chief Dale Robertson as a National Forest Scenic Byway on November 11, 1988. It was also designated by the State of Colorado Transportation Commission as a State Scenic and Historic Byway on September 22, 1989. Forty-seven (47) miles of this route, from Ridgway to Lizard Head Pass, are adjacent to the

analysis area. This was the first designated National Scenic Byway in the State. This nationally popular drive connects the historic towns of Durango, Silverton, Ouray, Ridgway, Telluride, Rico and Cortez. The Byway traverses some of the most spectacular, rugged and primitive landscapes in America. The area is rich in cultural resources ranging from the Archaic and Anasazi habitations, to the colorful mining era of the San Juan Mountains in the 1800's, including the development of the narrow gauge railways through the area.

Semi-primitive Non-motorized (3A Management Areas)

There are approximately 13,700 acres of this environment within the analysis area. Figure III-14 is a reduced scale map showing the approximate location of these areas.

Semi-primitive Non-motorized recreation is the management emphasis for these areas, in both roaded and unroaded areas. Recreation opportunities such as hiking, horseback riding, hunting, cross-country skiing, etc. are available. Visual resources are managed so that development activities are not visually evident or remain visually subordinate. Retention VQO is the norm in 3A Management Areas. Partial Retention VQO is inconsistent with the management prescription and the ROS class. User density is controlled by access. There are five (5) 3A management areas in the analysis area. They are:

1. Crater Lake area, located west of Overland Reservoir in the headwaters of Cow Creek, a tributary of West Muddy Creek. This is also one of the Dispersed Recreation Complex areas. It covers approximately 3,700 acres.

2. Muddy Basin area, located in the headwaters of East Muddy Creek. It covers approximately 1,250 acres.

3. Horse Ranch Park area, located west of Kebler Pass, is adjacent to the Raggeds Wilderness area. It covers approximately 2,550 acres.

4. Beckwith Peaks area, north of the West Elk Wilderness area and south of Lost Lake. It covers approximately 2,900 acres.

5. Crag Crest National Recreation Trail, on Grand Mesa, covers approximately 2,700 acres in the analysis area.

Administrative Sites

There are 10 building sites in the analysis area. Eight (8) of them are Administrative Sites and two (2) are recreation visitor centers. The two recreation visitor centers are identified under recreation. The eight Administrative Sites are displayed in the following table.

TABLE III-13. ADMINISTRATIVE SITES WITHIN ANALYSIS AREA				
SITE NUMBER	SITE NAME	DISTRICT	NUMBER OF BUILDINGS > 100 SQ.FT.	TOTAL SQ.FT. BUILDING SPACE
1	Hightower	Collbran	1	540
2	Lone Cone	Norwood	2	1,920
3	Mesa Lakes	Collbran	5	4,940
4	Sanborn (4 trailer spaces - to be phased out)	Norwood	-	0
5	Silesca	Ouray	2	1,632
6	Tab Basin (1 trailer)	Norwood	2	1,104
7	Ward Lake	Grand Junction	5	3,897
8	West Muddy	Paonia	2	1,329

Recreation Complexes

There are approximately 62,975 acres of this environment within the analysis area.

Recreation Complexes are areas of high density recreation use, mixed kinds of recreation use, sensitive recreation areas, or specialized recreation use. They include groups of facilities such as campgrounds, picnic grounds, visitor centers, interpretive sites, overlooks, permitted recreation residences, permitted lodges/resorts, permitted ski areas and Administrative Sites. Recreation Complexes have been grouped into three types. They are: 1) Developed Recreation Complexes, 2) Dispersed Recreation Complexes, and 3) Major Trail Systems. Sensitivity levels were subjectively set based on use (numbers of PAOT), amount of development, and proximity to State and Nationally designated sites.

Developed Recreation Complexes

Ten Developed Recreation Complexes have been identified in the analysis area. Figure III-15 is a reduced scale map showing the approximate location of these areas. They are:

1. The Powderhorn Ski Area complex, located on the north side of the Grand Mesa. It has a capacity of 1800 SAOT's. This is a highly sensitive Recreation Complex. (16,005 acres)

2. The Mesa Lakes complex, located on the north side of Grand Mesa. It includes two campgrounds (210 PAOT), two picnic grounds (95 PAOT), 33 recreation residences (132 PAOT), one lodge - resort (90 PAOT), and an Administrative Site. It is a highly sensitive Recreation Complex. (1825 acres)

3. The Island/Ward lake complex, located on the south side of Grand Mesa. It includes one visitor center (75 PAOT), five campgrounds (700 PAOT), two picnic grounds (40 PAOT), one boat ramp (35 PAOT), two Trailheads (85 PAOT), one interpretive site (35 PAOT), seven recreation residences (28 PAOT), two lodges - resorts (235 PAOT), and an Administrative Site. It is a highly sensitive Recreation Complex. (1870 acres)

4. The Grand Mesa complex, located south of Baron Lake, on the south side of Grand Mesa. It includes one campground (60 PAOT) and one organizational camp (150 PAOT). This is a moderately sensitive Recreation Complex. (1710 acres)

5. The Big Creek Reservoir complex, located on the northeast side of Grand Mesa. It includes one campground (130 PAOT). This is a moderately sensitive Recreation Complex. (580 acres)

6 . The Cottonwood Lake complex, located on the north side of Grand Mesa. It includes one campground (210 PAOT). This is a moderately sensitive Recreation Complex. (980 acres)

7. The Leon Peak complex, located on the east end of Grand Mesa. It includes two campgrounds (125 PAOT) and the dispersed area around Leon Lake. This is a moderately sensitive Recreation Complex. (2335 acres)

8. The Lost Lake complex, located near Kebler Pass. It includes one campground (65 PAOT), one lodge - resort (35 PAOT), and seven recreation residences (20 PAOT). This is a moderately sensitive Recreation Complex. (1115 acres)

9. The McClure Pass complex includes one campground (95 PAOT). It is a highly sensitive Recreation Complex. (1360 acres)

10. The Lands End Complex, located at the Lands End Observatory and in Whitewater Basin (at the westernmost end of Grand Mesa). It includes an overlook and visitor center (35 PAOT). It is a highly sensitive Recreation Complex. (2385 acres)

Dispersed Recreation Complexes

Five Dispersed Recreation Complexes have been identified in the analysis area. Figure III-16 is a reduced scale map showing the approximate location of these areas. They are:

1. The Kannah Creek Primitive area, on the west side of Grand Mesa. It is the only area outside of designated Wilderness that is classified as a Primitive (P) ROS class. The nearest roads are 3 miles away or separated from it by the rim of Grand Mesa. This is a highly sensitive Recreation Complex. (10,550 acres)

2. The Granby Reservoir area on the south side of Grand Mesa, is a popular 4 wheel-drive - backcountry fishing area and is classified as a Semi-primitive Motorized (SPM) ROS class. This is a highly sensitive Recreation Complex. (3720 acres)

3. The Flat Tops area on the northeast side of Grand Mesa, is classified as Semi-primitive Non-motorized (SPNM) and Semi-primitive Motorized (SPM) ROS classes. This is a moderately sensitive Recreation Complex. (16,105 acres)

4. The Crater Lake complex, west of Overland Reservoir, is classified as a Semi-primitive Non-motorized (SPNM) ROS class. This is a moderately sensitive Recreation Complex. (6410 acres)

5. The Priest Mountain Area, at the head of Leroux Creek. It is classified as Semi-primitive Non-motorized (SPNM) and Semi-primitive Motorized (SPM) ROS classes. This is a moderately sensitive Recreation Complex. (4895 acres)

Major Trail Systems

Five Major Trail System complexes have been identified in the analysis area. Figure III-17 is a reduced scale map showing the approximate location of these areas. They are:

1. The Crag Crest National Recreation Trail, a 10 mile loop trail offering many scenic vistas and a unique display of geologic history on the Grand Mesa. It includes one trailhead (50 PAOT), two campgrounds (85 PAOT), and one boat ramp (25 PAOT). It is a highly sensitive Recreation Complex. (2280 acres) (Approximately ___ % of this area is currently leased.)

2. The Crag Crest National Recreation Ski Trail (County Line Cross Country Ski Trail), a winter time extension of the Crag Crest National Recreation Trail. It is a series of four loop trails varying in length from .75 miles to 4.1 miles, offering many scenic vistas to the south. This trail is maintained and groomed by volunteers. This is a moderately sensitive Recreation Complex. (1080 acres)

3. The Skyway Cross Country Ski Trail, north of the County Line Cross Country Ski Trail. It is a series of 3 loop trails, varying in length from 2.15 to 2.8 miles, offering many scenic vistas to the north. It has a 2.3 mile link to the County Line Ski Trail. This trail is maintained and groomed by volunteers. This is a moderately sensitive Recreation Complex. (1110 acres)

4. The Ward Lake Cross Country Ski Trail, adjacent to the Island/Ward Lakes complex. It provides a wide range of trail loops and difficulty classes. This trail is maintained and groomed by volunteers. This is a moderately sensitive Recreation Complex. (1060 acres)

5. The proposed American Discovery Trail route crosses Grand Mesa following the Kannah Creek Trail, the Crag Crest National Recreation Trail and the Sunlight-Powderhorn Snowmobile Trail. This is a moderately sensitive Recreation Complex.

Watersheds of Special Interest to Municipalities

There are approximately 117,000 acres of this environment within the analysis area. Figure III-18 is a reduced scale map showing the approximate location of these areas.

Historically, cities and towns located in the valleys below the Forest have depended on the Forest for supplying high quality water for domestic use. This water was relatively cheap since treatment costs were low or non-existent, and water was delivered by gravity feed systems. The Forest Service has recognized the importance of this use, and in some instances, adopted special management provisions for domestic supply watersheds. In other instances, Congress has designated certain watersheds for limited or single purpose use, in order to safeguard water supplies. However, it is not reasonable to expect that management practices alone will eliminate the need to treat water supplies prior to domestic use. The Forest has a management area designation (10E) for municipal watersheds, in the Forest Plan. Under the present Plan, only those areas that had existing administrative designation as municipal watersheds were assigned to 10E. No watersheds within the analysis area have been assigned to 10E, but there are a number of watersheds which serve as community water supply sources.

Within the analysis area, there are fifteen watersheds or areas that provide water to nearby communities. The relative sensitivity of each of these watersheds differs, depending on whether they are surface or groundwater supplies; whether the water is taken directly off the Forest or below the Forest boundary; the number of people the system services; and whether it is a primary, secondary or future supply of water for the community.

The following table identifies some of the characteristics of the municipal water supplies used to classify the watersheds.

TABLE III-14. MUNICIPAL WATERSHEDS IN THE ANALYSIS AREA

NAME	COMMUNITY	SOURCE TYPE	SUPPLY TYPE	INTAKE PT. LOCATION
Leroux Ck.	Hotchkiss	Surface	Primary	Well below N.F.
Surface Ck.	Cedaredge	Surface	Primary	On N.F.
Ward Ck.	Orchard City	Surface	Primary	On N.F.
Doughspoon Ck.	Delta	Surface	Secondary	On N.F.
Oak Ck.	Delta	Surface	Secondary	On N.F.
Dirty George Ck.	Delta	Surface	Secondary	On N.F.
Kannah Ck.	Grand Junction	Surface	Primary	N.F. boundary
N.Fk. Kannah Ck.	Grand Junction	Surface	Primary	N.F. boundary
Whitewater Ck.	Grand Junction	Surface	Future	No intake
Wiley Spring	Crawford	Groundwater	Primary	On N.F.
Bell Springs*	Paonia	Groundwater	Primary	On N.F.
West Terror Springs	Pitkin Mesa	Groundwater	Primary	On N.F.
Big Ck.	Rural Grand Junction	Surface	Primary	Well below N.F.
Cottonwood Ck.	Rural Grand Junction	Surface	Primary	Well below N.F.
Coal Ck.	Crested Butte	Surface	Primary	On N.F.

* Adjacent to analysis area.

In all the municipal watersheds in the analysis area, authorized uses such as livestock grazing, ORV/ATV use, dispersed recreation, and timber harvest are ongoing. Some watersheds have only limited use, while in others the use is extensive. None of the municipal watersheds being considered in the analysis area have been afforded special protection under the current Forest Plan. Grand Junction is on record as being concerned about activities ongoing and planned within the Kannah Creek and Whitewater watersheds. Generally speaking, protection of water quality is the issue, however for those

situations where springs are the source of water, the quantity of water flowing from the spring is also of potential concern.

Slopes 40-60%

There are 33,530 acres with 40 to 60 % slopes in the analysis area. Figure III-19 is a reduced scale map showing the approximate location of these areas.

These slopes are not unique to any particular vegetation types, soil conditions or geologic formations. They are dispersed over the Forest in no particular pattern. These slopes, in nearly all cases, are covered with vegetation undisturbed by the activities of man. This is primarily because of the expense and engineering challenges of doing anything on such steep ground. Road building is the one exception. Some segments of roads do exist on these slopes, because no other route could be found.

For the majority of the soils in the analysis area on the 40-60% slope range, the erosion hazard will be a high.

These areas are particularly sensitive to the human activities. Any disturbance has a disproportionately high potential for soil loss and mass movement. Revegetation of these areas is difficult because of soil and seed loss. Activities on steep slopes may be visible from long distances.

Slopes >60%

There are 3415 acres with Slopes greater than 60% in the analysis area. Figure III-20 is a reduced scale map showing the approximate location of these areas.

As with 40 to 60% Slopes, these slopes are not unique to any particular location on the Forest. The expense and engineering challenges of doing anything on such steep ground has precluded past activities. Many of these slopes do not have vegetative cover beyond occasional grasses and lichens.

Large scale disturbances on these slopes will result in exposing large amounts of surface area to accelerated erosion. Any disturbance produces a high potential for soil loss and mass movement. In most cases, disturbance can be considered an irreversible and irretrievable commitment of resources. Revegetation potential of these slopes is extremely poor, due to poor soil development. Disturbances are highly visible.

Wildlife Special Habitats

Big Game Winter Range

There are approximately 207,450 acres of Big Game Winter Range within the analysis area. Figure III-21 is a reduced scale map showing the approximate location of these areas.

Much of the identified winter range is included in Forest Plan Management Areas 5A and 5B, which have a management emphasis on Big Game Winter Range; however, these management areas do not encompass all the identified winter range. Most of the winter range utilized by the big game found in the analysis area, is located on private and BLM administered lands, below the Forest. Only a small percentage (7%) of the total winter range is within the analysis area (on National Forest System lands).

Winter range habitat capability, or carrying capacity, is a major limiting factor on big game populations. Because there is such a small percentage of this critical habitat within the analysis area, it is of particular importance in evaluating the effects of oil and gas development, among other forest management activities. One of the Forest Plan goals is to increase winter range carrying capacity for elk and deer on National Forest System lands.

The current winter range carrying capacity (within the analysis area) is approximately 2,000 elk and 5,800 deer (these values were determined in cooperation with the Colorado Division of Wildlife). The existing deer and elk populations exceed these capacities.

Most Big Game Winter Range occurs at lower elevations (6,000 - 8,000 feet). Characteristics of this habitat include presence of browse species, general southern exposures, and topographic and vegetation features that provide thermal, security and escape cover. These characteristics are normally found within the pinyon-juniper, Gambel's oak and mountain brush communities. Within the analysis area, these communities tend to be localized along the Forest boundary. Previous discussions on vegetation indicate that the pinyon-juniper and mountain brush communities are in intermediate to late seral stages, while much of the oakbrush community is in early seral stages. Generally, better forage is available in early and intermediate seral stages. Later seral stages provide better cover. A mixture of different plant communities, at varying stages is the desired condition.

Animals concentrate on winter ranges from as early as October, until late February or March, depending on climatic conditions and human disturbances. Mule deer and elk utilize winter ranges throughout the analysis area. Deer rely almost exclusively on browse species, like Gambel's oak, sagebrush, mountain mahogany, serviceberry, bitterbrush, choke cherry and juniper. Elk prefer grass, but will use browse when grass is unavailable during periods of heavy snow and in late winter. Because elk are larger animals than mule deer, they can use higher winter range areas.

Other big game species use more localized winter range areas. A small herd of bighorn sheep (approximately 25 animals) winters west of Anderson Gulch, on Battlement Mesa. Desert bighorn sheep have recently been reintroduced into the Roubideau drainage (1991), and additional transplants are planned for the future. Preferred winter range areas will be identified as these animals establish use patterns in this drainage. Both species utilize areas where grasses, forbs, and browse species are present.

Mountain goats are only found in the Marcellina Mountain and Ragged Mountain areas, both located within the Ragged Wilderness. Winter range for these animals is also within the Wilderness area, located on steep, wind-swept ridges where grass and browse species occur.

Elk Calving Areas

There are approximately 45,230 acres of Elk Calving Areas within the analysis area. Figure III-22 is a reduced scale map showing the approximate locations of these areas.

Elk Calving Areas are typically located in transitional habitat between winter and summer ranges - in the Gambel's oak/mountain brush/aspen plant communities. An ideal elk calving area is in aspen with a dense understory, interspersed with grass and sagebrush openings and scattered small ponds. Calving can occur from mid-May through late-June.

Migration Routes and Staging Areas

These areas vary with climatic condition. As a result, no acreage figures are available for these *Affected Environments*. As more knowledge is gained, traditional use areas may be identified.

In spring, mule deer make a slow migration toward their summer range through the Gambel oak and aspen habitat types. During the summer aspen, spruce-fir, and subalpine habitats are heavily used. The aspen habitat type is by far the most heavily utilized. As fall approaches a rapid migrational movement is made to winter ranges in early October. This process can be accelerated by hunting pressure and climate. During the fall the oak and pinyon-juniper habitats are most heavily utilized especially where these habitats are interspersed with sagebrush.

Elk move fairly rapidly to the higher country as snow cover recedes in the spring. The oakbrush, sagebrush, and aspen ecosystems contain most of the calving areas. Aspen and oak areas interspersed with small ponds are important calving and nursery sites. After calving the cows and calves gather into large nursery groups at higher elevations where disturbance from humans is very low. Elk can easily be prematurely moved to their winter ranges by human related activity, early snowfalls, or a lack of forage. Migration to winter ranges is often very fast and over distinct migration routes and travel corridors. These migration routes have been mapped in some locations.

Bighorn Lambing and Breeding Areas

As identified in an earlier discussion, a small herd of bighorn sheep inhabits Battlement Mesa. Breeding usually occurs on traditional areas between October and February with the peak period occurring in late November to mid-December. Breeding areas are part of the winter range, located west of Anderson Gulch. Young, usually one, are born on traditional lambing grounds after a slow spring migration toward their summer range, generally located east and north of Anderson Gulch (see Figure III-23). The same bedding grounds are used every year on their summer-fall ranges and are easily disrupted by disturbance.

Summer Range (Concentrated Use)

Big game summer range is found throughout the analysis area. There are approximately 81,440 acres of elk summer concentration areas (concentrated use summer range) within the analysis area. Figure III-24 is a reduced scale map showing the approximate locations of these areas for elk. The majority of these areas are on Grand Mesa.

Big game animals concentrate on these areas from mid-June through mid-August. High quality forage, security and lack of disturbance are characteristics of these areas. Animals require these areas during the periods of lactation, calf rearing, antler growth and for building fat reserves necessary to survive the coming winter. Spruce-fir habitats intermixed with meadows, where roads or other human activity is minimal, is preferred habitat. These areas are important as hiding cover to afford protection and security from disturbance, and to keep big game animals on the summer range as long as possible. Though these areas have not yet been classified as critical habitat by the CDOW, the CDOW feels it is just a matter of time until concentrated use summer range is classified as critical habitat.

Sage Grouse Leks

Sage Grouse Leks or traditional strutting/breeding grounds are extremely important to the survival of this species. One lek has been identified within the analysis area, near Miramonte Reservoir. The lek and surrounding nesting area encompass approximately 160 acres, within the analysis area. Additional leks may be found during field checks at the APD stage. Leks generally range in size from five to forty acres, but some are much larger. While leks are usually surrounded by sagebrush, the strutting area may be somewhat sparsely to moderately vegetated with sagebrush. Barring the complete elimination of the physical lek itself, the leks are used generation after generation. In late February and March male sage grouse begin to gather on traditional leks.

Breeding generally occurs on the leks during late March and April. This is subsequently followed by nesting and young rearing in May, June, and July. Sage grouse hens will build the nests in the vicinity

of a lek (usually within a 2 1/2 mile radius), within 7-10 days following breeding. Nests are normally under sagebrush plants where they are protected from late spring storms. The young feed on insects such as beetles and ants and gradually begin to forage on succulent plants. As summer approaches the sage grouse move to higher elevations where more succulent green vegetation is still plentiful, however, they never get too far from the sagebrush ecosystem. As winter approaches, the sage grouse move to lower elevations or wind blown slopes where snow depths are shallow. The extent of winter movement depends solely on food and cover availability as it relates to snow depths.

Threatened, Endangered and Sensitive Species

Endangered Species

Spineless hedgehog cactus (Echinocereus triglochidiatus var. inermis): This cactus species is the only listed endangered plant species (at this time) occurring on the Uncompahgre Plateau and on Grand Mesa. The plant is found in partial shade, in duff accumulations under pinyon pine trees and infrequently among sagebrush, on cool exposures between 5,000 and 8,000 feet. Plants are believed to be susceptible to grazing and trampling by livestock. Pinyon clearing projects and removal by plant collectors has also led to the species' decline.

Uncompahgre Fritillary Butterfly (Boloria acrocnema): The known range of this butterfly lies outside the area covered by this analysis. This butterfly is found on only a couple known sites in alpine habitats above 12,000 feet. These sites are located south and west of the analysis area.

Peregrine Falcon (Falco peregrinus): The peregrine falcon nests on large cliffs overlooking or situated near streams, rivers, and possibly lakes. There are no known active nesting sites on National Forest System lands within the analysis area; however, a number of sites within the analysis area have potential habitat for peregrine falcons. Intensive surveys have not been conducted to determine if potential nest sites are occupied. Peregrines prey on birds (which are taken in flight), so cliff nesting habitat near large streams or rivers with extensive riparian habitat is considered to be optimum habitat. These riparian habitats are rich in bird life. Habitat surveys were done in the summer of 1992. Human presence or disturbance at any nest site can cause abandonment of the eyrie. Occupation of the many potential nesting sites will become more likely as the population recovers throughout Colorado.

Bald Eagle (Halieetus leucocephalus): The bald eagle is known to occur year-round within the analysis area, however, no known nesting sites have been found on National Forest System lands within the analysis area. Bald eagles are also common migrants through the area during spring and fall. In addition, there are many bald eagles which winter in the main river drainages both on and off the Forest. Winter habitat is characterized by an abundant, readily available food supply in conjunction with one or more suitable night roost sites. Roosting sites occur in large trees along these rivers. The bald eagle is primarily a fish eater, particularly during the summer. In winter, food consists of waterfowl, fish, carrion and small mammals. During the nesting season bald eagles have been observed around several lakes on Grand Mesa. Nesting is possible and will become likely as recovery of bald eagle populations continues throughout the United States. Nest trees are usually large trees with heavy crowns capable of supporting their large nest, which can be six feet or more in width and height. The nest tree is usually located along or near water, but nests have been located quite some distance from water.

Candidate Species

The U.S. Fish and Wildlife Service has identified a number of Candidate species, for which the Service currently has substantial information on hand to support the biological appropriateness of proposing to list as either endangered or threatened. The following species within this category are found or are suspected to occur on the Forest in the area under analysis:

Colorado River Cutthroat Trout (Oncorhynchus clarki pleuriticus): The Colorado River cutthroat trout is a USFWS Category 2 candidate species. Of all the trout species known to exist on the Forest, this is the most sensitive to changes in habitat quality and the most limited in it's range , in terms of habitat quality and quantity. Historically, this species occupied most of the streams in the analysis area, but due to habitat loss, competition from introduced species and changes in habitat quality, their numbers have steadily declined. The Forest is currently in the process of cooperating with the CDOW in preparing a conservation plan designed to keep this species from becoming listed as endangered.

Mexican Spotted Owl (Strix occidentalis lucida): The Mexican Spotted Owl has already been proposed for listing as an threatened species on the portion of the Forest that is included in this analysis. To date, no spotted owl sightings or nests have been confirmed on the Forest. However, nests have been found in Mesa Verde National Park and on the San Juan, Rio Grande, and Pike/San Isabel National Forests. Based on 10 Mexican spotted owl nests in Colorado, suitable habitat can be categorized as prime and possible habitat.

Prime Habitat consists of: deep, narrow canyons characterized by sheer, often tiered walls. Vegetation may be dominated by pinyon-juniper in an old age class, or with a mixed conifer component such as Douglas-fir, ponderosa pine, white fir, spruce, and limber pine. A typical nest site might be along or beneath a canyon rim or cliff especially where a smaller drainage comes into the main canyon. The area has pinyon-juniper on the tops of the rims and mixed conifer in the actual drainages themselves and also may have some oak or cottonwood trees mixed in the forested stands.

Possible Habitat consists of: any steep slope over 20%, with mixed conifer vegetation could be spotted owl habitat (based on New Mexico and Arizona nesting data).

Preliminary studies indicate spotted owls prefer dense mature conifer stands and steep slopes. It is not yet known if it requires old growth forests. Three owl nests have been located in montane (mixed conifer) forests on steep slopes and four from steep-walled canyons with montane and pinyon-juniper forests. Nest sites could be in an old raptor or magpie nest, large tree cavity or where a large limb broke off the main trunk of a tree, woodrat nest on cliff ledge or in tree, or in an "witches broom" mistletoe defect. Nests are often located inside the hollow top of a broken tree bole. Roosting occurs during the day when these owls retire to a secluded roost on a limb in a large shady tree or to a ledge of a cave. The spotted owl preys upon bushy-tailed woodrats, rabbits, gophers, squirrels, mice, bats, large insects and other prey species. Potential spotted owl habitat has been identified and mapped on the entire Uncompahgre Plateau and in the Lone Cone area. In 1990, a spotted owl report was filed for the Battlement Mesa area. The area was revisited but the reported sighting was never verified.

Northern Goshawk (Accipiter gentilis): See discussion under Management Indicator Species, page III-47.

Boreal Western Toad (Bufo boreas boreas): The boreal western toad is a species that has rapidly declined over its range in the southern Rocky Mountains. This toad was once widespread on the Grand Mesa and areas to the east. Grand Mesa, the Uncompahgre Plateau, and the West Elk Mountains still have these toads present. The preferred habitat of this species is willow patches, sedge meadows, abandoned beaver ponds, and in shallow water near mud flats around lakes, ponds, marshes, and wet meadows at elevations above 8000 feet. It is found near water but not generally in it, except in the tadpole stage. Breeding habitat includes both permanent and temporary water sources. Breeding occurs in late May or June. In late July and August masses of black tadpoles are found in shallow water that is inaccessible to fish. This toad is expected to be placed on the endangered species list in the near future.

North American Wolverine (Gulo gulo luscus): The wolverine is the largest terrestrial member of the weasel family. It is on the State list of endangered species in Colorado. Wolverines once occupied the area in low numbers and likely still occur in some areas within the analysis area.

Wolverines are a naturally low-density species throughout their range. They are a solitary animal with large home ranges and have a low reproductive potential. Hornocker (1981), estimated a density of one wolverine per 25 square miles on a study area in northwest Montana. Young (2-3) are born every two or three years at den sites in February, March or April. Wolverines feed on small mammals, forest grouse, ptarmigan, fish, fruits, and ungulate carrion. The wolverine inhabits coniferous forests and alpine areas during the summer and move to somewhat lower elevations during the winter, where carrion or weak big game animals could be present. Riparian zones are preferred feeding areas. This species prefers large unroaded areas where contact with humans is minimal. Current threats to its survival include intentional and unintentional trapping, incidental poisoning, and logging and road development in its existing habitat.

North American Lynx (Felis lynx canadensis): The lynx is also on the Colorado State endangered species list. While never abundant in Colorado it has suffered population declines across most of its southern range. The lynx prefers boreal forest situations consisting of spruce, fir, lodgepole pine, and mixed aspen-conifer stands. Coniferous forest thickets are preferred feeding sites because it's principal prey species, the snowshoe hare, frequents these sites. The snowshoe hare makes up the majority of the lynx's diet while mice, small mammals, and birds make up the rest. Lynx densities are also low, ranging from 6-10 square miles per individual. While dense stands of young conifers are used for feeding, mature stands of conifers are used for denning, cover, and as travel corridors. Like the wolverine, the lynx's range has dwindled due to hunting and trapping pressure, predator control programs, and loss of Wilderness forests. Continued threats to the lynx include: forest fragmentation caused by roading and logging of timber. Roads result in increased accessibility for trappers on foot or on snowmobiles.

Ferruginous Hawk (Buteo regalis): The ferruginous hawk inhabits unbroken grassland prairies, plains, and broken hills. Within the analysis, this habitat is found along the lower Forest boundaries around the base of Grand Mesa and on both sides of the Uncompahgre Plateau. No nests have been identified on the Forest at this time. Nesting occurs in April and May. Breeding pairs are extremely sensitive to human activity near their nests and will easily abandon their nests. Loss of native grassland and shrubland habitat has resulted in the decline of this species.

White-faced ibis (Plegadis chihi): This species is probably not found on the Forest in the area covered by this analysis.

Long-billed curlew (Numenius americanus): At this time it is not known whether this species' habitat extends onto the Forest.

Skiff milkvetch (Astragalus microcymbus): This plant has been identified as present in the Elk Mountains and is likely to be present within the analysis area. Habitat at known sites is in sandy soils on sagebrush slopes, at elevations around 7,000 to 8,000 feet. Little is known about the plant at this time and it has been found only in a few locations.

Grand Mesa Penstemon (Penstemon mensarum): The Grand Mesa penstemon has been found only in Mesa and Delta Counties on the Grand Mesa and surrounding areas. It is found in the Gambel oak and aspen plant associations at elevations from 7,200 to 9,500 feet.

Degener beardtongue (Penstemon degeneri): This penstemon is one of the rarest and least known penstemons in Colorado. The plant has been identified from Grand Mesa and only a few other sites in the State of Colorado. It is most likely to be found in the pinyon-juniper woodlands.

Paradox lupine (Lupinus crassus): Known only from western Montrose County on the west side of the Uncompahgre Plateau, it grows beneath junipers on fairly open ground, and within stands of mixed pinyon and juniper. It usually grows in sandy soils derived from the Dakota, Burro Canyon, and Chinle Formations. It can also be found on adobe hills. Mining and road construction are the greatest threats to the habitat of this species.

The gray wolf *(Canis lupis)* and the grizzly bear *(Ursus arctos)* are listed as endangered species in the State of Colorado. It is doubtful that either of these species are still found within the analysis area even though reports of these species occasionally occur.

Sensitive Species

The following species have been proposed for listing as sensitive species on the Grand Mesa, Uncompahgre and Gunnison National Forests:

Mammals

River Otter (*Lutra canadensis*)
Colorado Hognosed Skunk (*Conepatus mesoleucus figginsi*)
Wolverine (*Gulo gulo luscus*)
Lynx (*Felis lynx canadensis*)
Spotted Bat (*Euderma maculatum*)
Abert's Squirrel (*Sciuris aberti*)

Birds

Mexican Spotted Owl *(Strix occidentalis lucida)*
Boreal Owl *(Aegolius funereus)*
Flammulated Owl *(Otis flammeolus)*
White-faced Ibis *(Plegadis chihi)*
Columbian Sharp-tailed Grouse *(Pedioecetes phasianellus columbianus)*
Southwestern Willow Flycatcher *(Empidonax trailii extimus)*

Fish

Colorado River Cutthroat Trout *(Oncorhynchus clarki pleuriticus)*

Insects

Uncompahgre Fritillary Butterfly *(Boloria acrocnema)*
Great Basin Silverspot Butterfly *(Speyeria nokomis nokomis)*

Amphibians

Boreal Western Toad *(Bufo boreas boreas)*

While the Region does not have an "official" sensitive species list, these species have nevertheless been proposed by either the Region or the Forest to be on such a list. Several of these species have already been discussed under Management Indicator Species or under Candidate Species. Several of the remaining species could be affected by oil and gas development activities and are briefly discussed below:

The spotted bat may be found in a variety of habitats including open ponderosa pine, desert shrub, and pinyon-juniper woodlands. They roost alone in rock crevices high up on steep cliff faces. Cracks and crevices 1-2" wide in limestone or sandstone cliffs are critical roosting sites. They are found in relatively remote, undisturbed areas suggesting that they may be sensitive to human disturbance.

The boreal owl is closely associated with high elevation spruce-fir and lodgepole pine forests due to their dependence on these forest types for foraging year round, as it does not migrate during the winter. Nesting habitat structure consists of forests with a relatively high density of large trees, open understory, and multi-layered canopy. These owls nest in cavities made by woodpeckers or in natural

holes in snags. They feed chiefly on small forest mammals such as the red-backed vole. These owls have been documented on the Grand Mesa. They may also occur on the Plateau and in the West Elk Mountains. Nesting activity begins with calling in February and young are hatched in April, May, or June. The owl is sensitive to human disturbance.

The flammulated owl is found in all areas of the analysis area in mixed forests from pine and oak to aspen, spruce, and fir. They nest in natural or woodpecker made cavities. This owl is entirely insectivorous in its food habits. Nesting begins in May and June.

The river otter has been reintroduced into the Gunnison and San Miguel River systems. It spends most of its time in or adjacent to the river. It feeds mostly on fish.

The Southwestern willow flycatcher inhabits deciduous woods and riparian zones within the area covered by this analysis. Nesting occurs in May and June. Very little is known about the population of this species in this area at the present time.

Utility Corridors / Electronic Sites

There are approximately 4535 acres of this environment within the analysis area

The analysis area has approximately 57 miles of existing Utility Corridor and 5 miles of proposed Utility Corridor. These corridors include 46 miles of existing 345 KV power transmission line, 20 miles of existing 10 inch gas pipeline and 25 miles of proposed 22 inch gas pipeline. The Utility Corridor is located in four separate corridor's. They are:

1. Stevens Gulch to Hightower corridor crosses Hubbard Park and Buzzard Divide. It is an existing 24 mile 345 KV power transmission line corridor.

2. Old Highway 90 corridor crosses the Uncompahgre Plateau. It is an existing 16 mile 345 KV power transmission line corridor, an existing 20 mile 10" gas pipeline corridor and a proposed 20 mile 22" gas pipeline corridor. The different utilities in this corridor run parallel to each other for about 9 miles across the plateau and split on each end.

3. Flatiron corridor crosses the south end of the Uncompahgre Plateau. It is an existing 6 mile 345 KV power transmission line corridor.

4. Naturita corridor crosses the Naturita Division of the Forest. It is a proposed 7 mile 22" gas pipeline corridor.

There are seven electronics sites in the analysis area. Raspberry, is a major electronics site which includes a Forest Service Microwave Base Radio and 17 special use permittees. Mesa Point, includes a Forest Service Microwave Base Radio and two special use permittees. Two sites, Mud Hill and Pilot Knob, are Forest Service repeater stations. The remaining three sites; Scales Lake, Terror Creek and Indian Point, are single special use permittee.

Primary Rangeland (6B Management Areas)

There are approximately 395,000 acres of this environment within the analysis area. Figure III-25 is a reduced scale map showing the approximate location of these areas.

Approximately 35 percent of the study area is currently classified in the 6B Management Prescription in the Forest Plan, which provides for an emphasis on livestock grazing. The 6B prescription area constitutes what is known as "primary range", which denotes an area used by livestock

in a preferential manner and is the Primary Rangeland used in calculating the grazing carrying capacity of an allotment. Any activity which substantially alters the livestock carrying capacity of the grazing allotment will require careful consideration and mitigation.

Rangelands are defined as groups of ecological plant communities, dominated by herbaceous and low growing woody vegetation, which provide forage and cover, for domestic livestock and numerous species of wildlife. Rangelands, when properly managed, also contribute significantly to reduced overland water flows, reduced soil movement, improved water quality, improved biodiversity of both plant and animals, and can contribute to improved visual quality.

Rangelands on this Forest are dominated by plant associations affiliated with and dominated by various species of grasses, sedges, forbs, and shrubs. The rangeland plant communities constitute the primary food supply for most wildlife species and seasonally dependent livestock. Primary Rangelands provide the majority (up to 80%) of the available forage within the analysis area.

Primary Rangelands vary significantly in vegetative composition , varying in terms of physical plant make up, condition and production. Plant associations range from the alpine zone above 13,000 feet in elevation, to the cold desert grasslands and shrublands of the mountain foothills, at an elevation of 6,000 feet.

Historical use of the Forests rangelands, primarily by domestic livestock has resulted in significant change from the original native vegetation. Where past use was abusive, soil loss occurred, reducing the range site productivity, and allowing less desirable plant species to invade. For example, significant dominance by big sagebrush in most rangeland sites today, reflects a disproportionate percentage of big sage in the plant community. Such changes have resulted in reduced productivity, increased soil movement, reduced water quality, and greater management challenges to reverse the less than desirable trend.

Ecologically, and for classification purposes, rangelands have been separated into plant associations, represented by criteria associated with the climax vegetative plant community. Climax is defined as the highest development of plant succession occurring in the plant community. The condition or relative health of the existing plant community is compared against the "climax" to determine rangeland condition or seral stage. Any natural physical change or man-induced change on those factors which control the condition or seral stage of the plant community can be monitored by evaluating the site against the climax plant association.

For monitoring purposes and ready reference, the rangeland plant associations of this Forest are broken down into shrublands, grasslands, and forblands which are keyed from the highest elevation down to the lowest (Johnston, 1987).

Lands Suited for Timber Harvest

There are approximately 287,000 acres of this environment within the analysis area. Figures III-26a and III-26b are reduced scale maps showing the approximate locations of suited aspen and conifer, respectively.

The land base determined to be suited for timber harvest was modified in the Forest Plan Amendment, completed in 1991. Procedures used for identifying suited lands are well described in the Supplemental EIS associated with this Plan Amendment.

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.

Economically efficient timber stands are those from which the total economic benefits of harvest (including such values as assigned value benefits from increased water production) exceed the costs of harvest activities.

This analysis has not been done specifically for the oil and gas analysis area. On the entire Forest none of the acres of tentatively suited timber lands are financially efficient, while 19% of the tentatively suited lands are economically efficient.

Much of the cost of timber removal is concentrated in the construction of roads. Access provided by oil and gas roads has the potential to make certain timber stands which have heretofore been unsuited because of economics, suited. There are approximately 61,000 acres within the analysis area that fall into this category. These acres were typed as "Category 3" in the recent Plan Amendment suitability analysis and are shown in Figures III-27a and III-27b. These areas could not be added to the suited timber base *until* a detailed environmental analysis was done, followed by a Forest Plan amendment process as prescribed by the National Forest Management Act and its regulations.

Maps of Affected Environments

The following figures are maps of the *Affected Environments* referenced in the previous discussions.

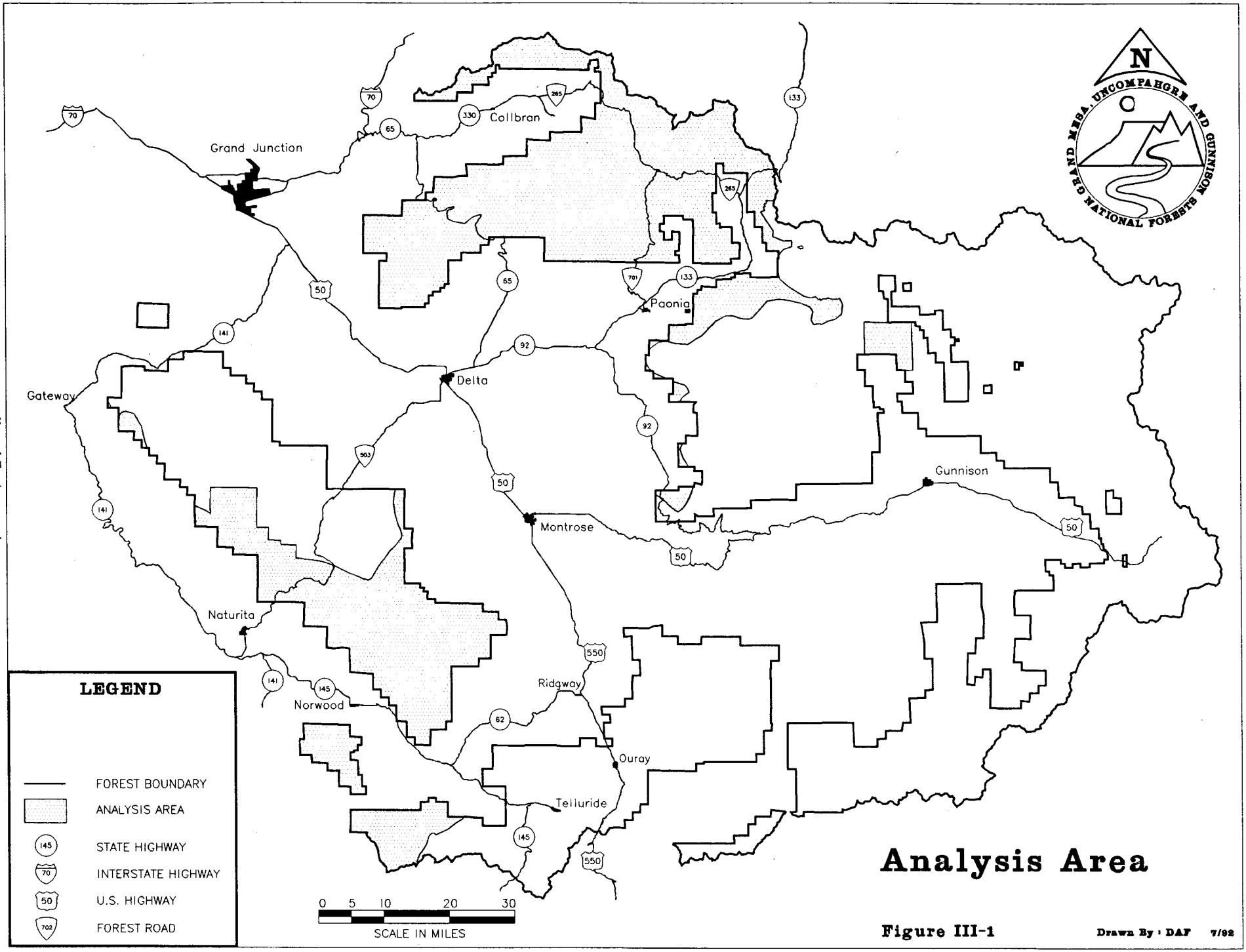
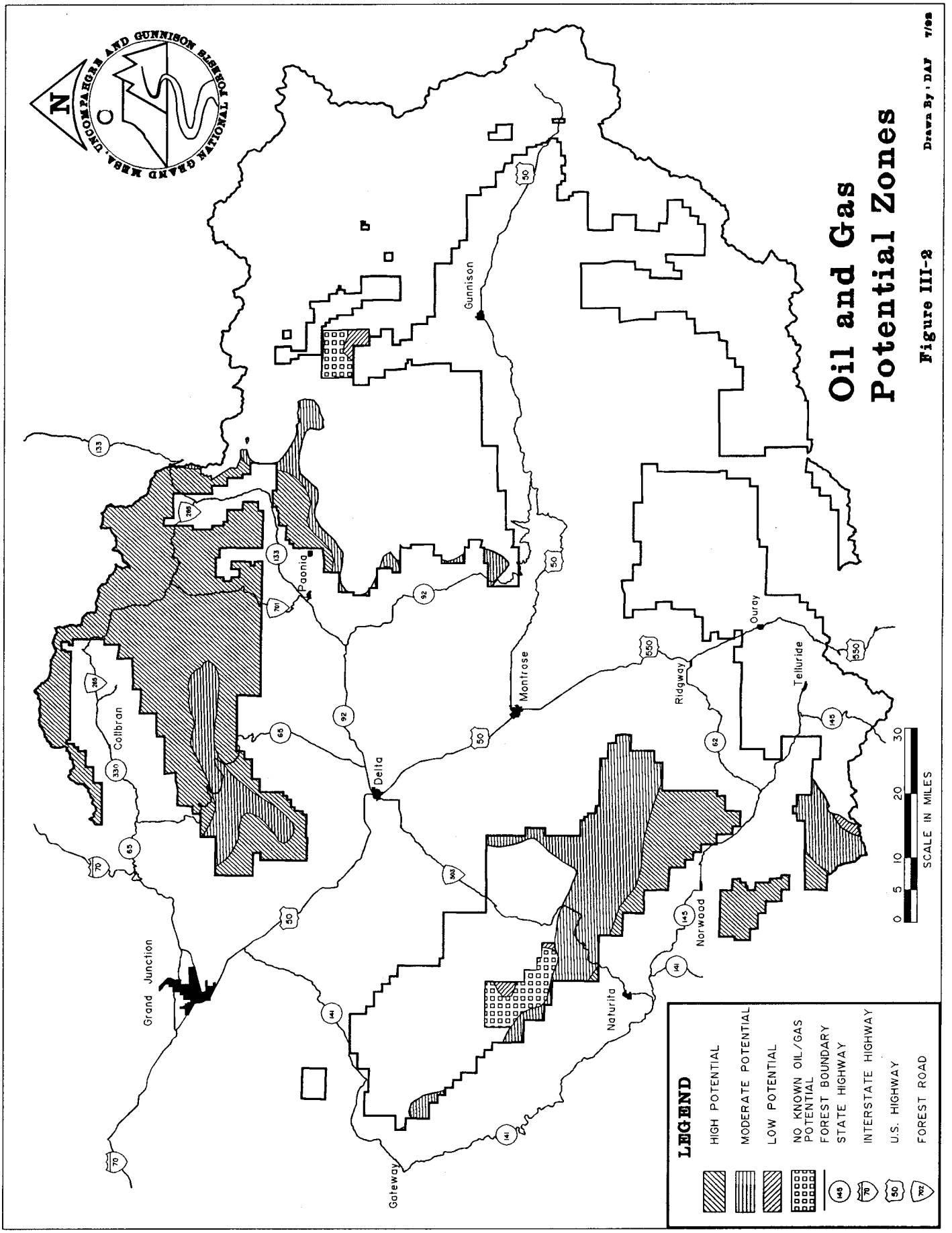
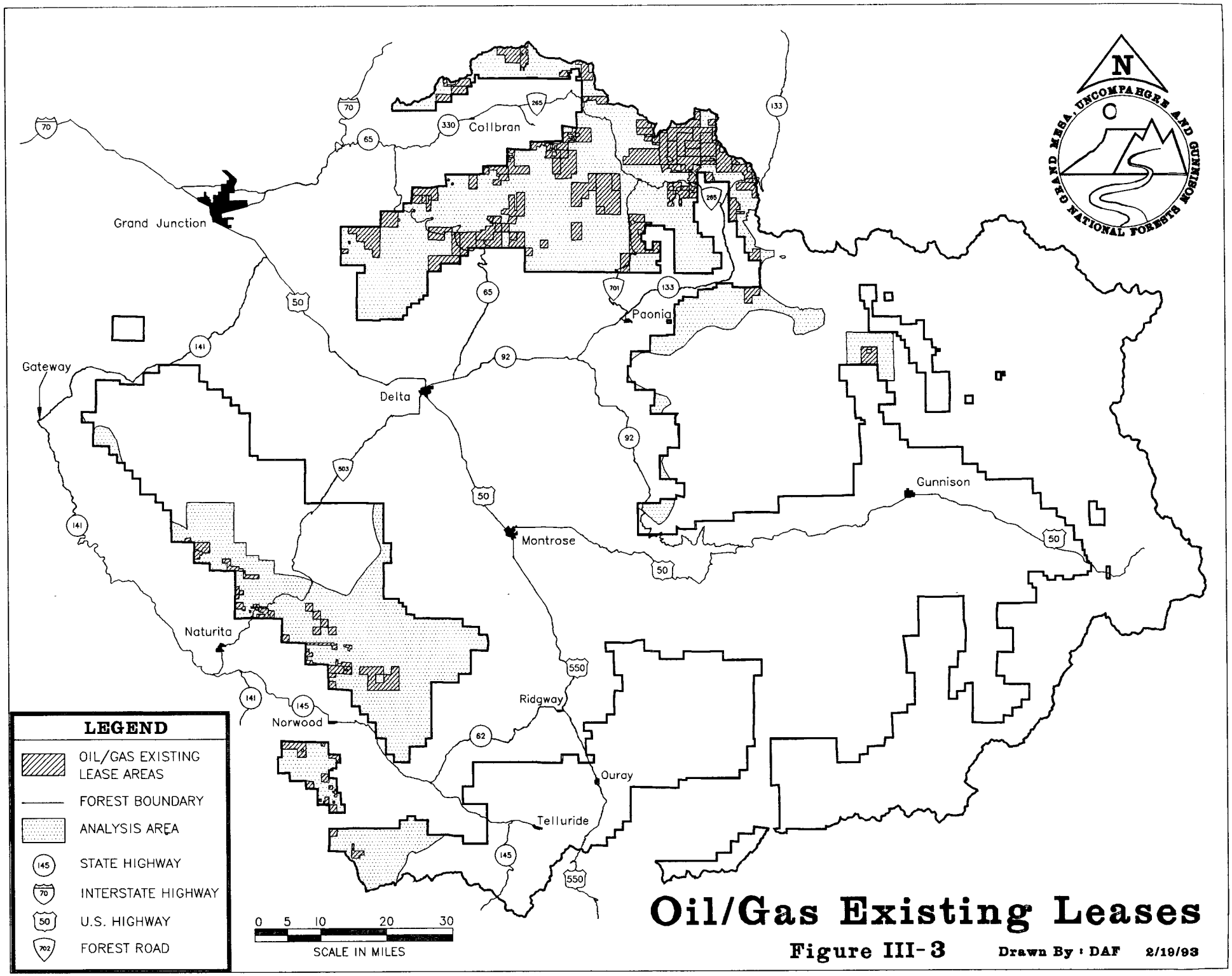


Figure III-1

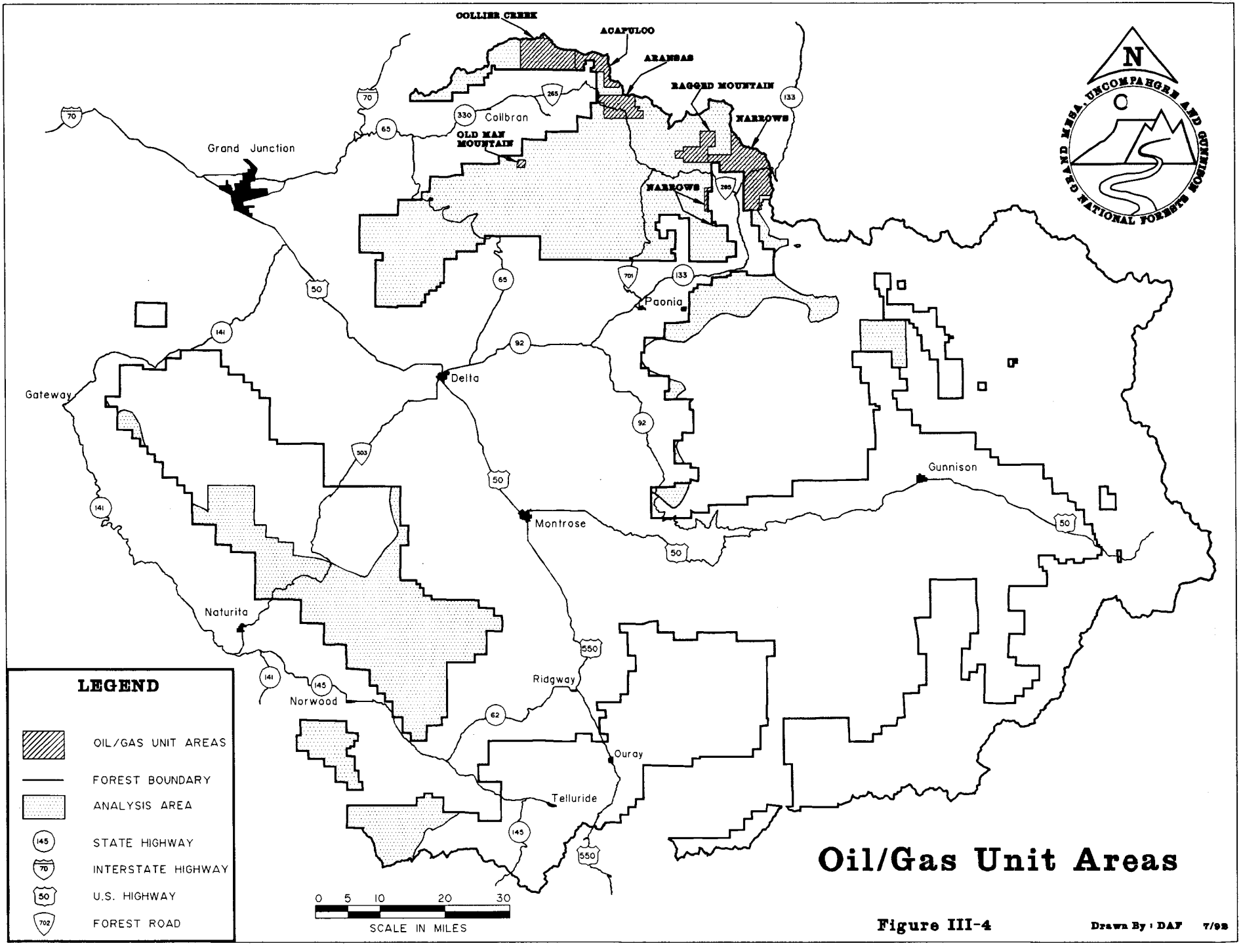
Drawn By : DAF 7/92


Oil and Gas
Potential Zones
Figure III-2
Drawn By: DAF 7/88
UNCOMPAHGRE AND GUNNISON NATIONAL FOREST
GRAND MESA
N
Gunnison
Paonia
Montrose
Ouray
Ridgway
Telluride
Delta
Collbran
Grand Junction
Gateway
Naturita
Norwood
LEGEND
HIGH POTENTIAL
MODERATE POTENTIAL
LOW POTENTIAL
NO KNOWN OIL/GAS POTENTIAL
FOREST BOUNDARY
STATE HIGHWAY
INTERSTATE HIGHWAY
U.S. HIGHWAY
FOREST ROAD
SCALE IN MILES
0 5 10 20 30



Oil/Gas Existing Leases

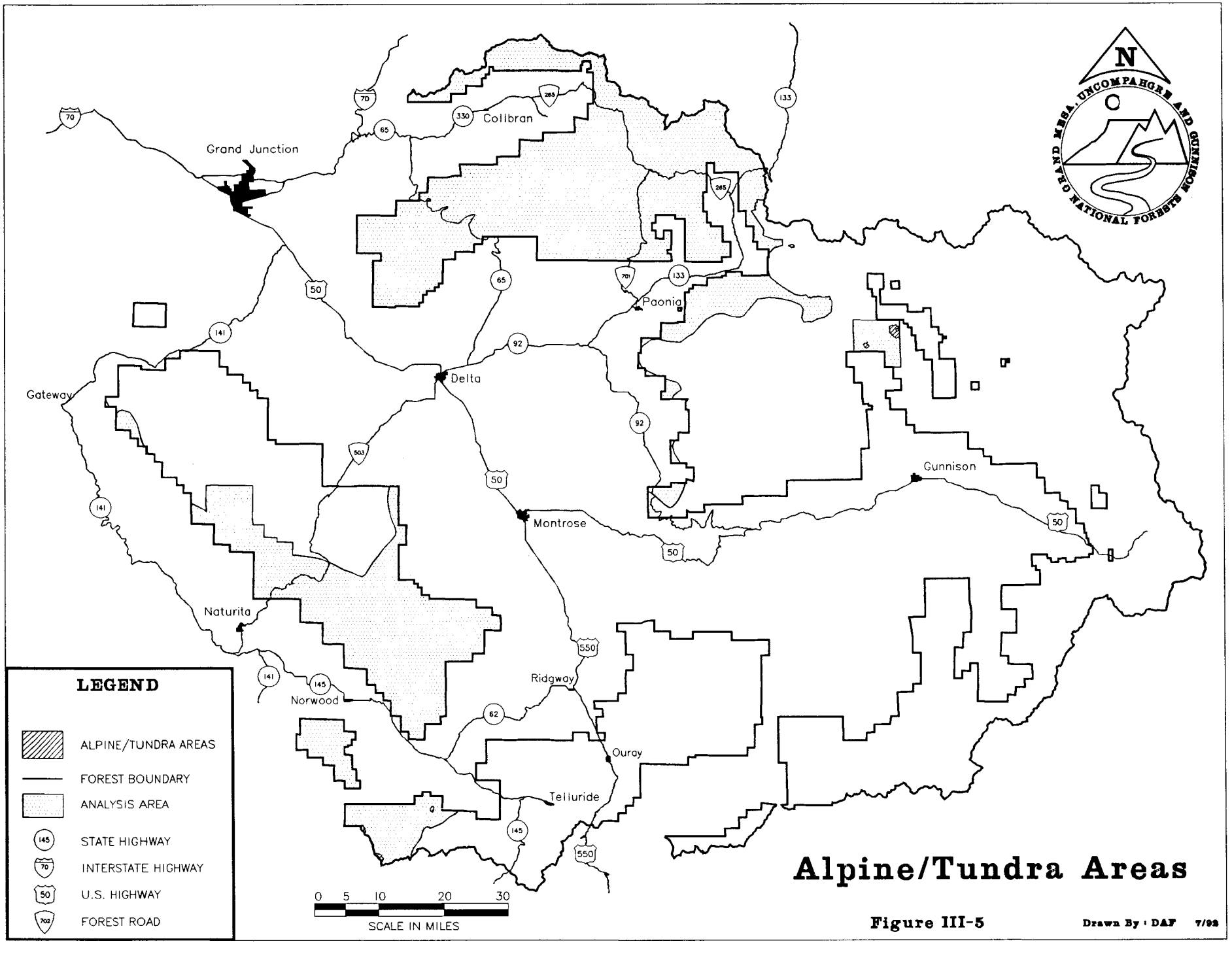
Figure III-3 **Drawn By : DAF** **2/19/93**

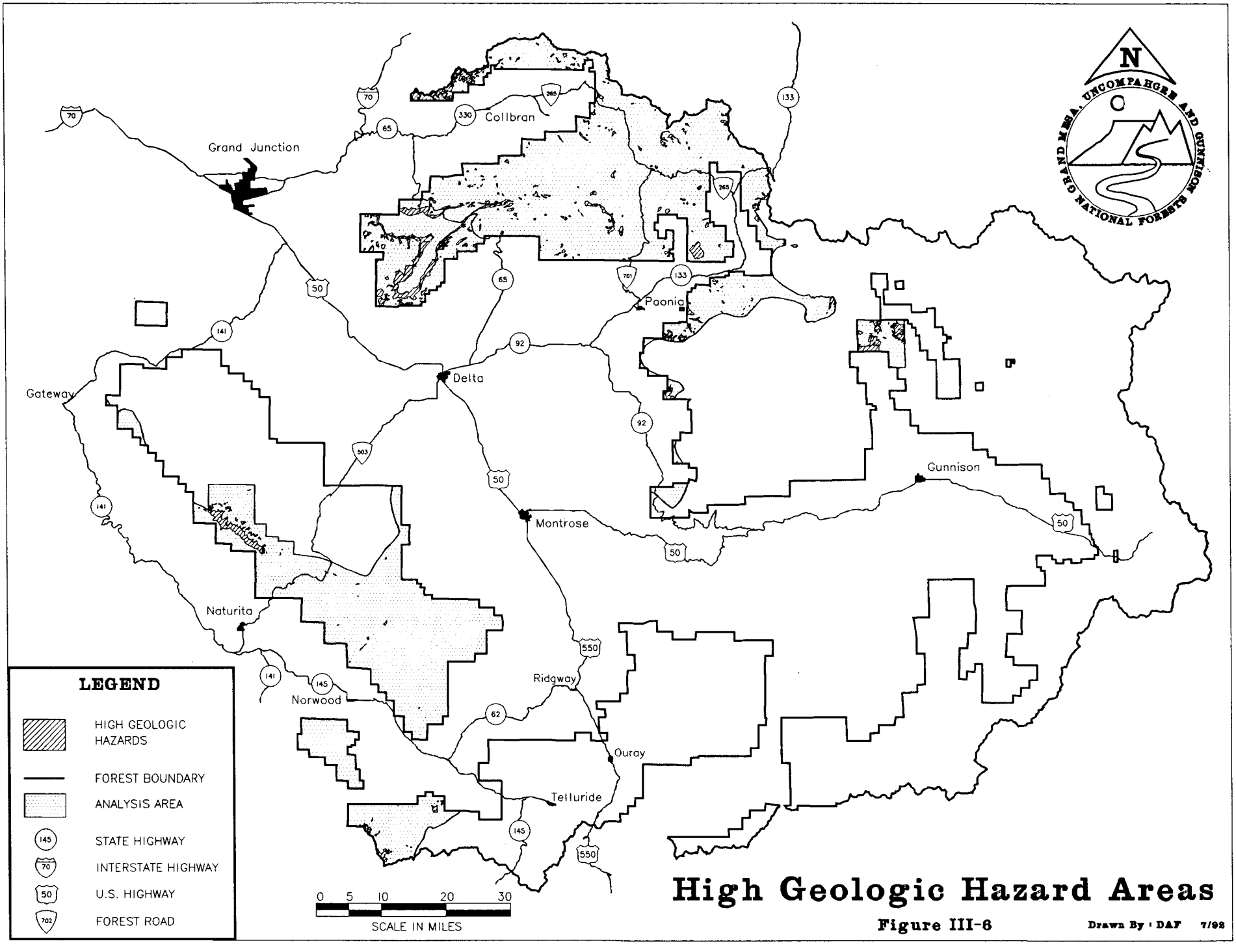


Oil/Gas Unit Areas

Figure III-4

Drawn By : DAF 7/93

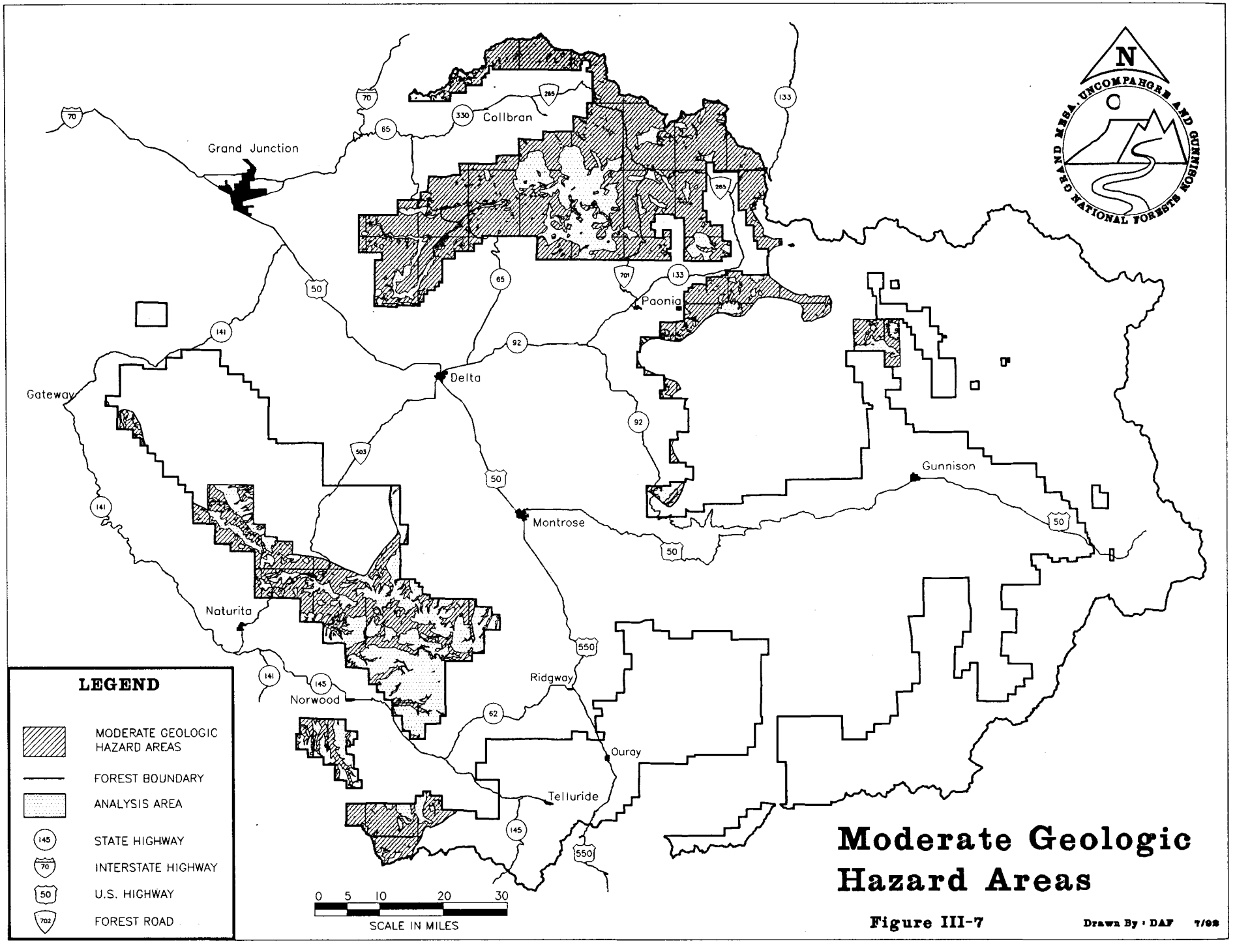

N
GRAND MESA, UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS
Grand Junction
Collbran
Paonia
Delta
Gateway
Gunnison
Montrose
Naturita
Norwood
Ridgway
Ouray
Telluride
LEGEND
ALPINE/TUNDRA AREAS
FOREST BOUNDARY
ANALYSIS AREA
STATE HIGHWAY
INTERSTATE HIGHWAY
U.S. HIGHWAY
FOREST ROAD
0 5 10 20 30
SCALE IN MILES
Alpine/Tundra Areas
Figure III-5
Drawn By : DAF 7/93



High Geologic Hazard Areas

Figure III-6

Drawn By : DAF 7/92



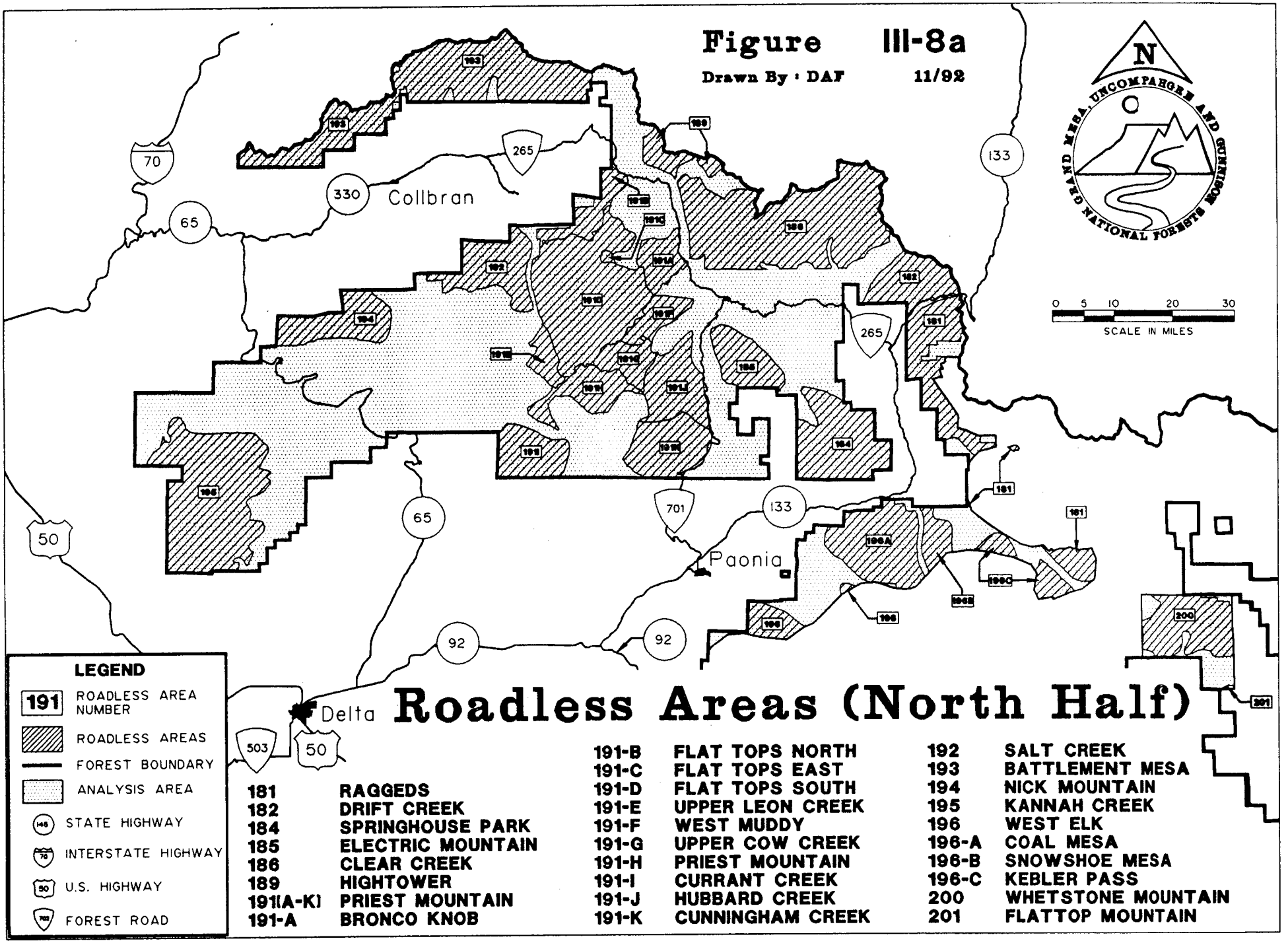
Moderate Geologic Hazard Areas

Figure III-7

Drawn By : DAF 7/02

Figure III-8a

Drawn By : DAF 11/92



Roadless Areas (North Half)

181	RAGGEDS	191-B	FLAT TOPS NORTH	192	SALT CREEK
182	DRIFT CREEK	191-C	FLAT TOPS EAST	193	BATTLEMENT MESA
184	SPRINGHOUSE PARK	191-D	FLAT TOPS SOUTH	194	NICK MOUNTAIN
185	ELECTRIC MOUNTAIN	191-E	UPPER LEON CREEK	195	KANNAH CREEK
186	CLEAR CREEK	191-F	WEST MUDDY	196	WEST ELK
189	HIGHTOWER	191-G	UPPER COW CREEK	196-A	COAL MESA
191(A-K)	PRIEST MOUNTAIN	191-H	PRIEST MOUNTAIN	196-B	SNOWSHOE MESA
191-A	BRONCO KNOB	191-I	CURRANT CREEK	196-C	KEBLER PASS
		191-J	HUBBARD CREEK	200	WHETSTONE MOUNTAIN
		191-K	CUNNINGHAM CREEK	201	FLATTOP MOUNTAIN

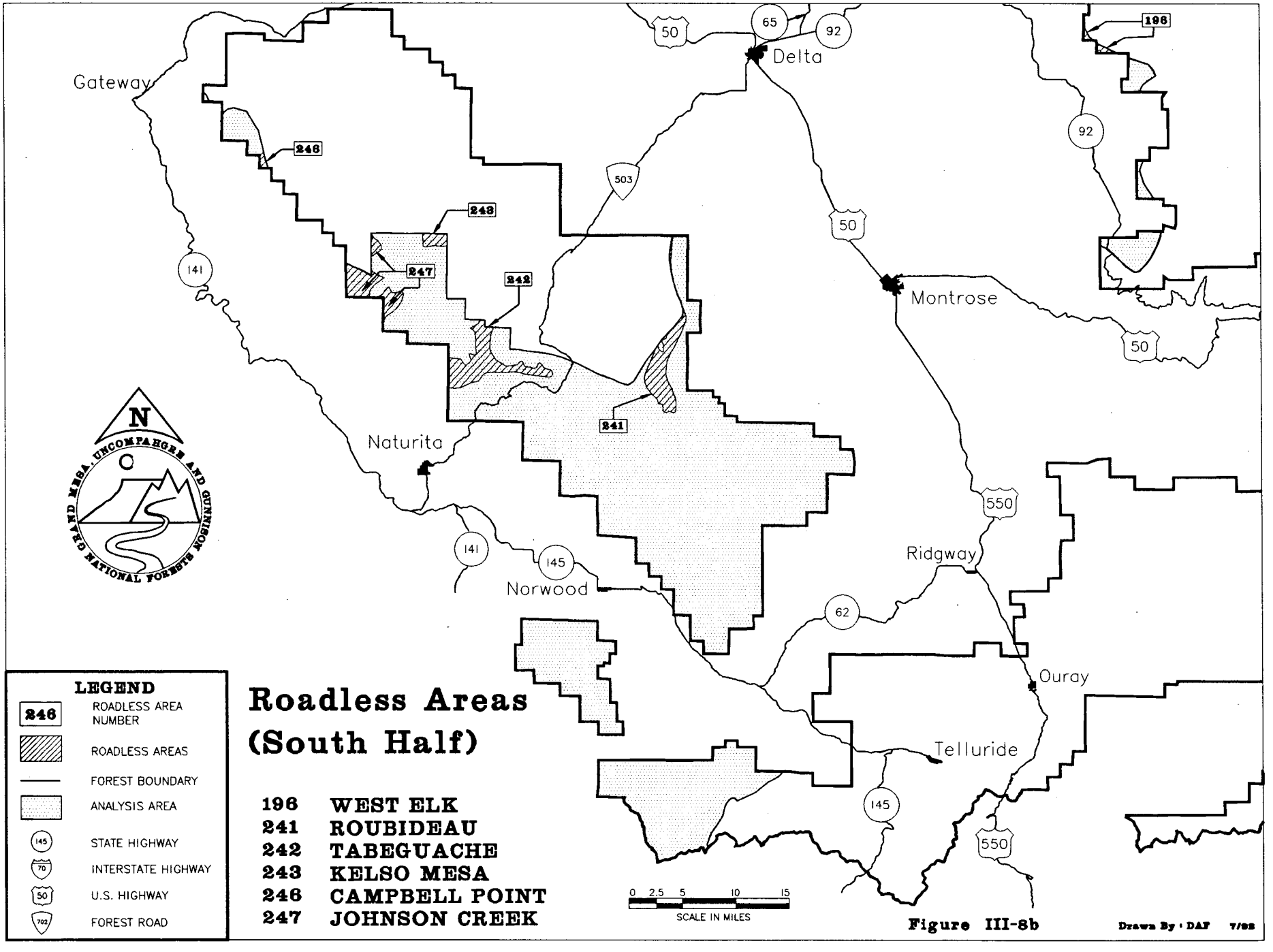
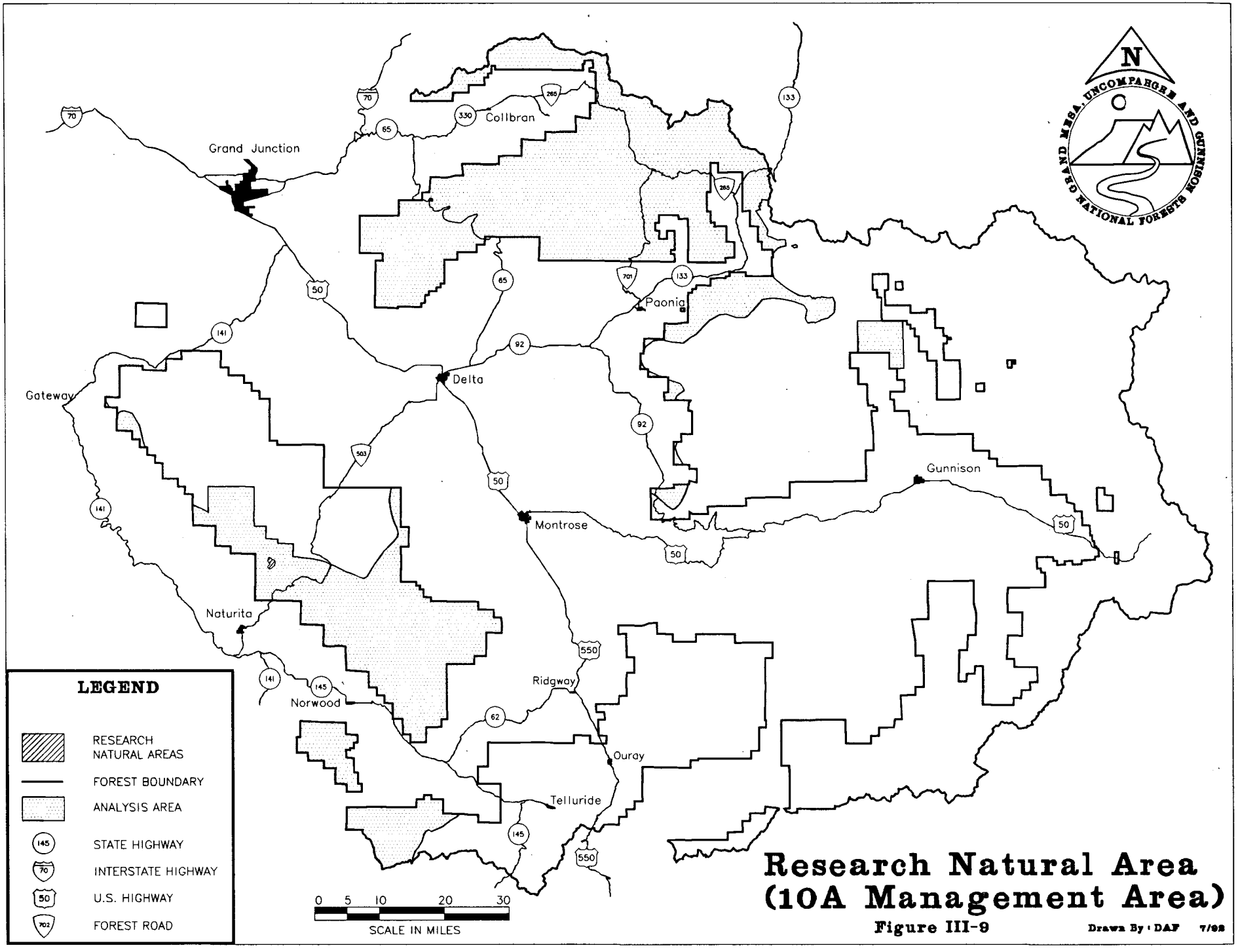


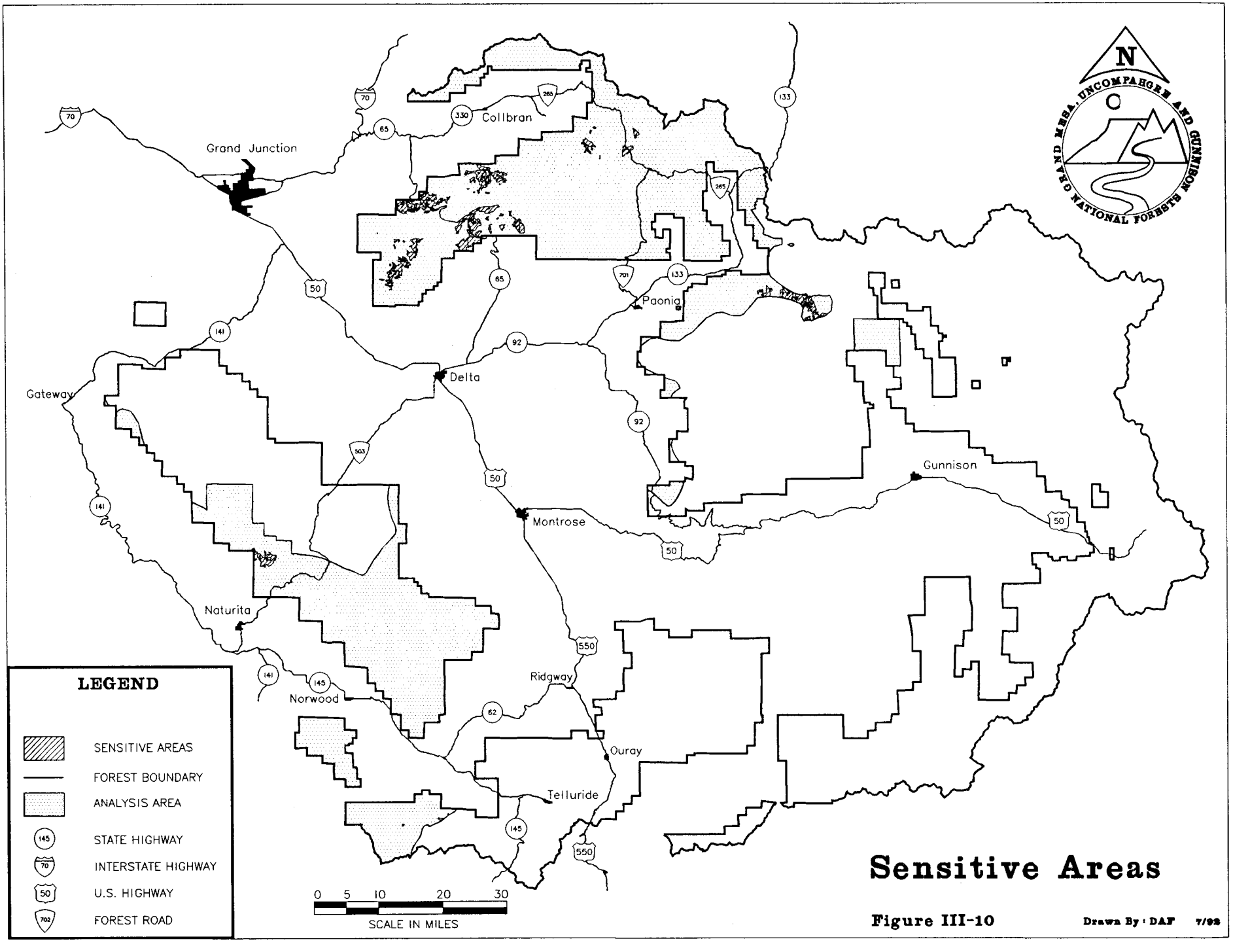
Figure III-8b

Drawn By : DAF 7/02



Research Natural Area (10A Management Area)

Figure III-9 Drawn By: DAF 7/98



Sensitive Areas

Figure III-10

Drawn By : DAF 7/92

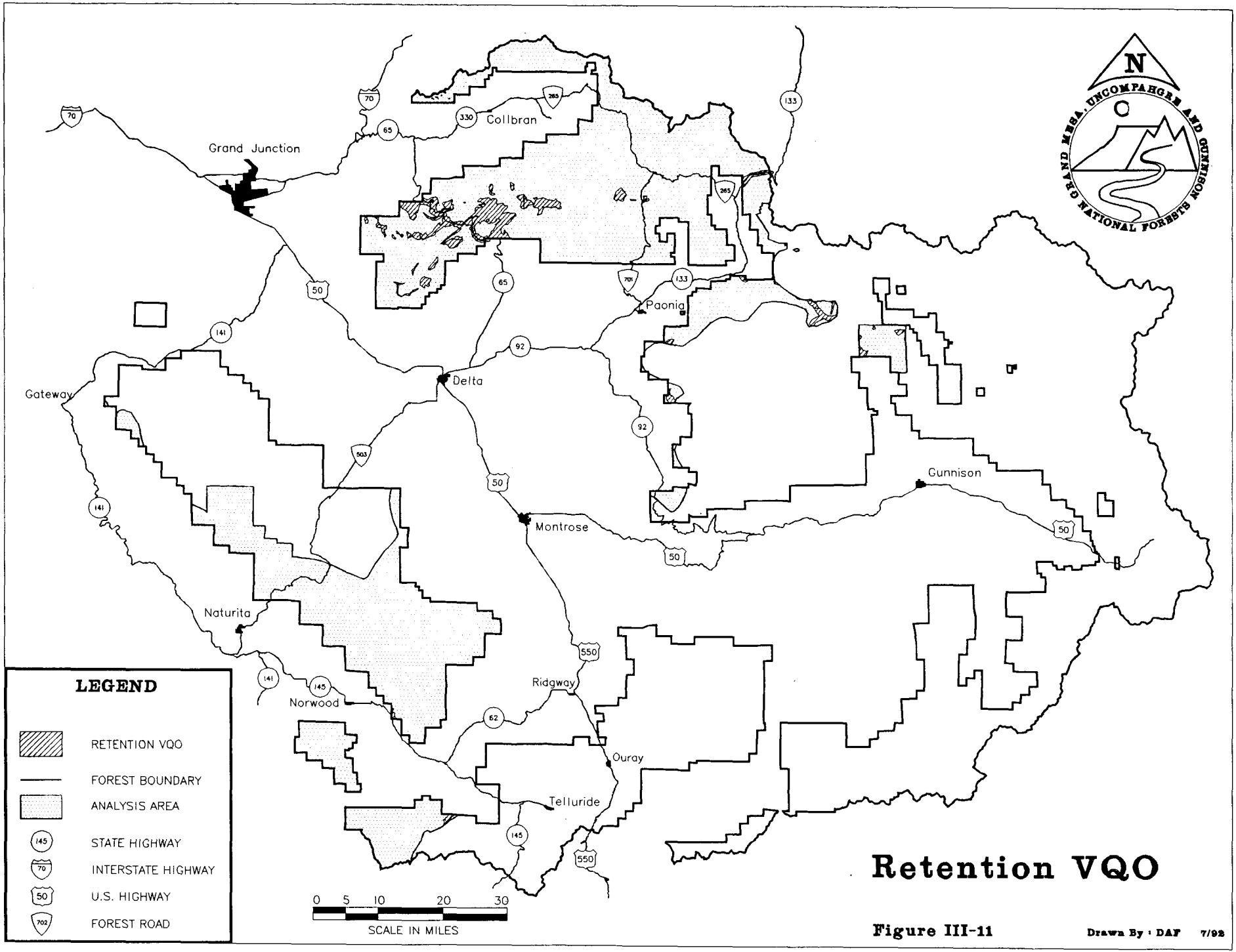
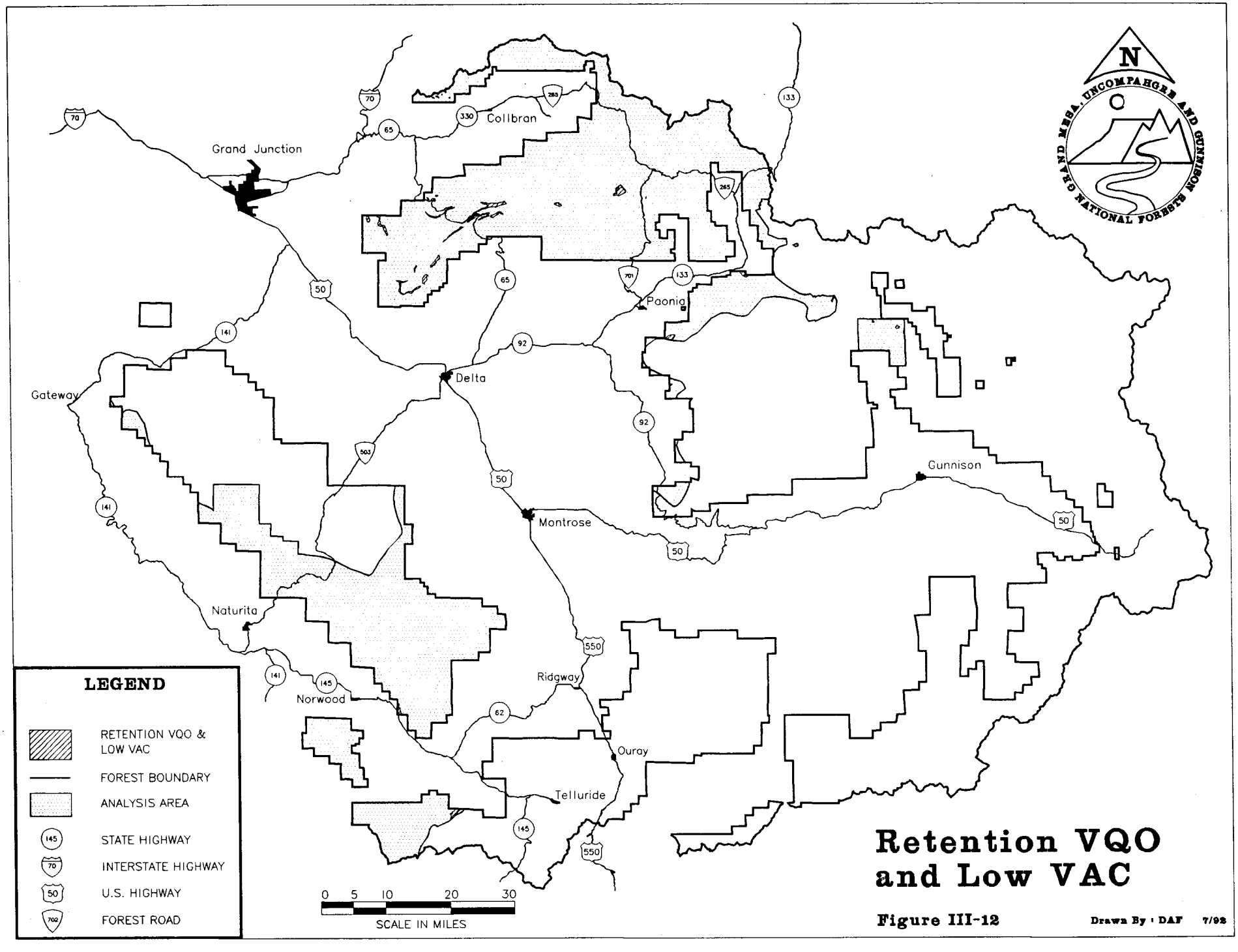


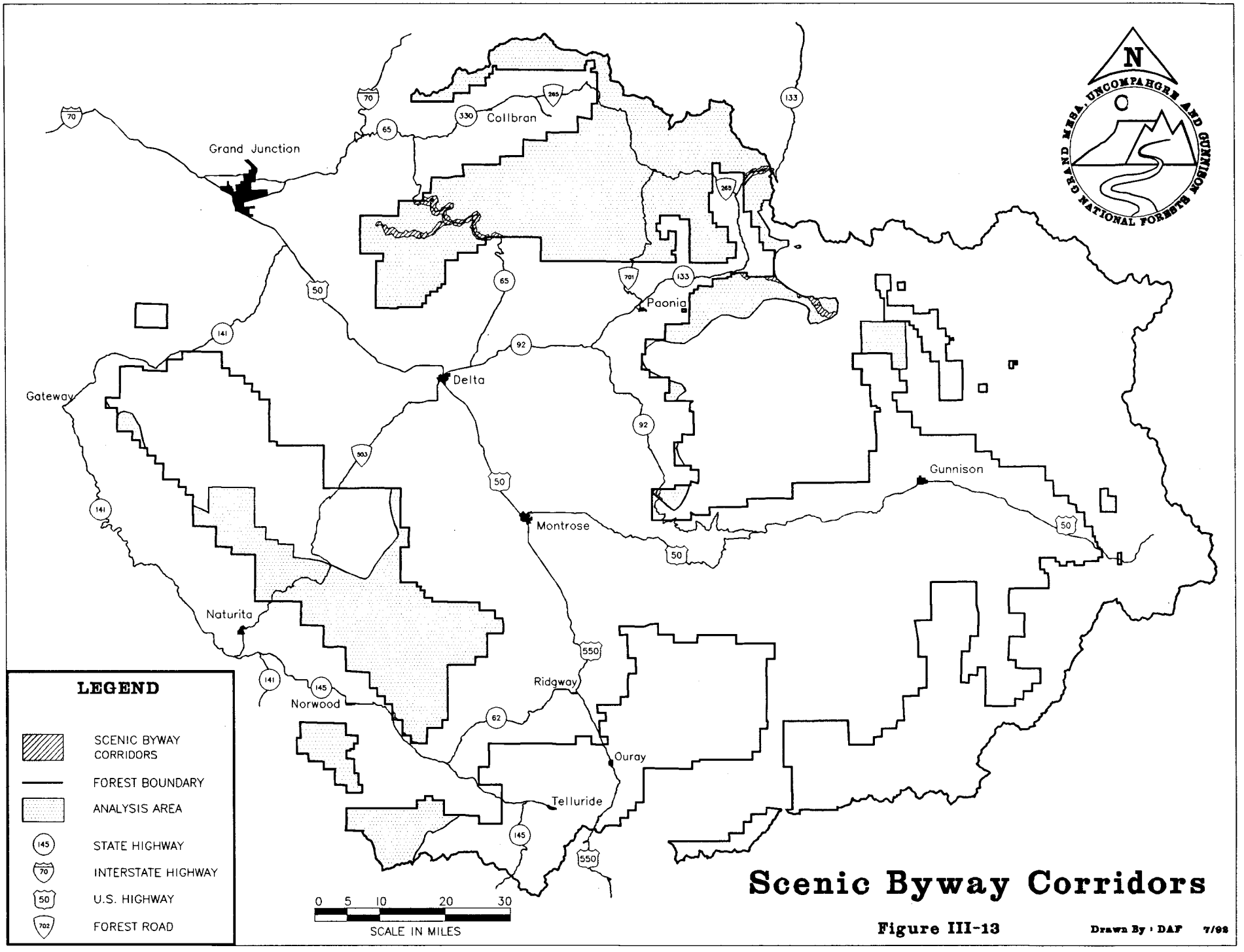
Figure III-11

Drawn By : DAF 7/92



Retention VQO and Low VAC

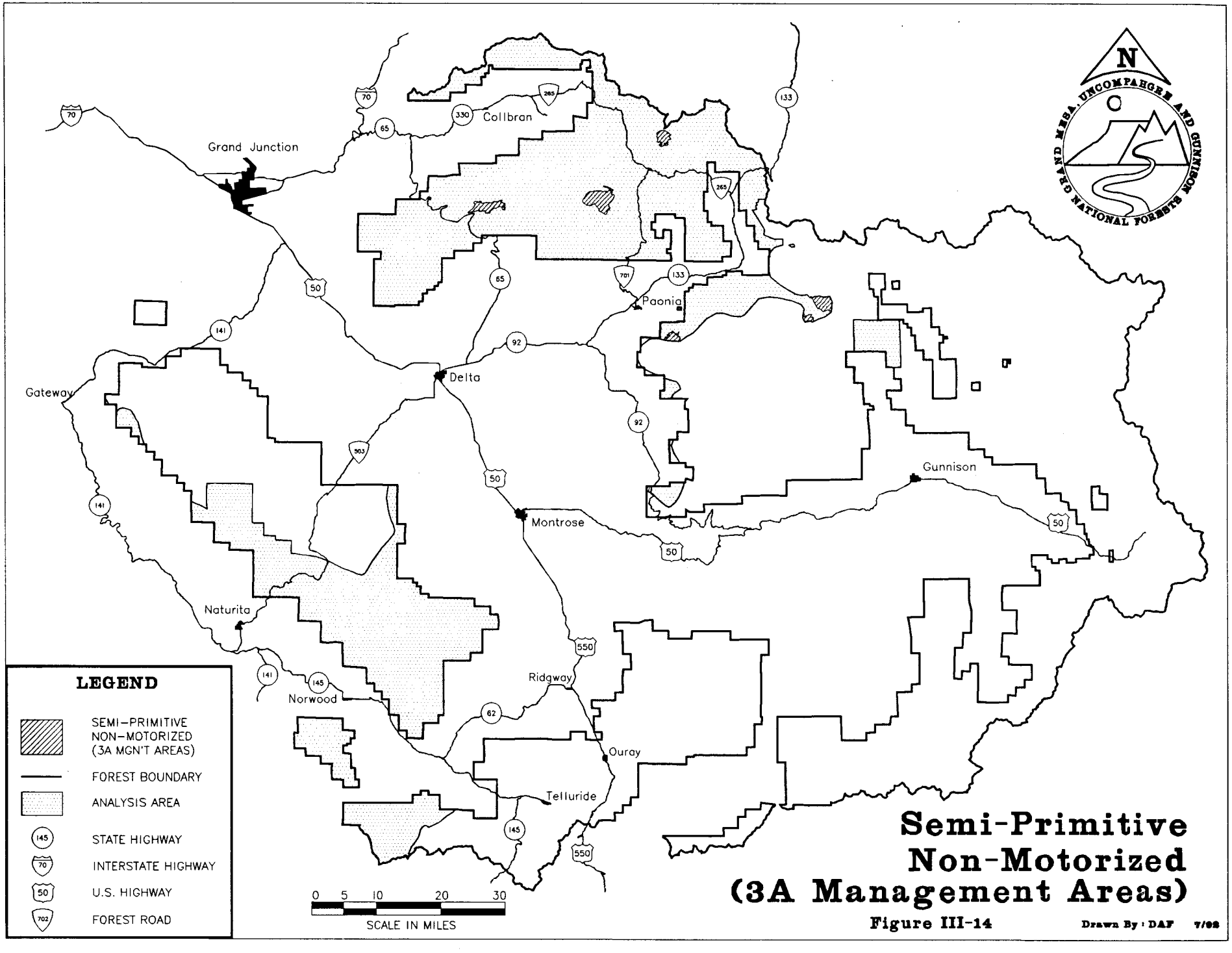
Figure III-12 Drawn By : DAF 7/92



Scenic Byway Corridors

Figure III-13

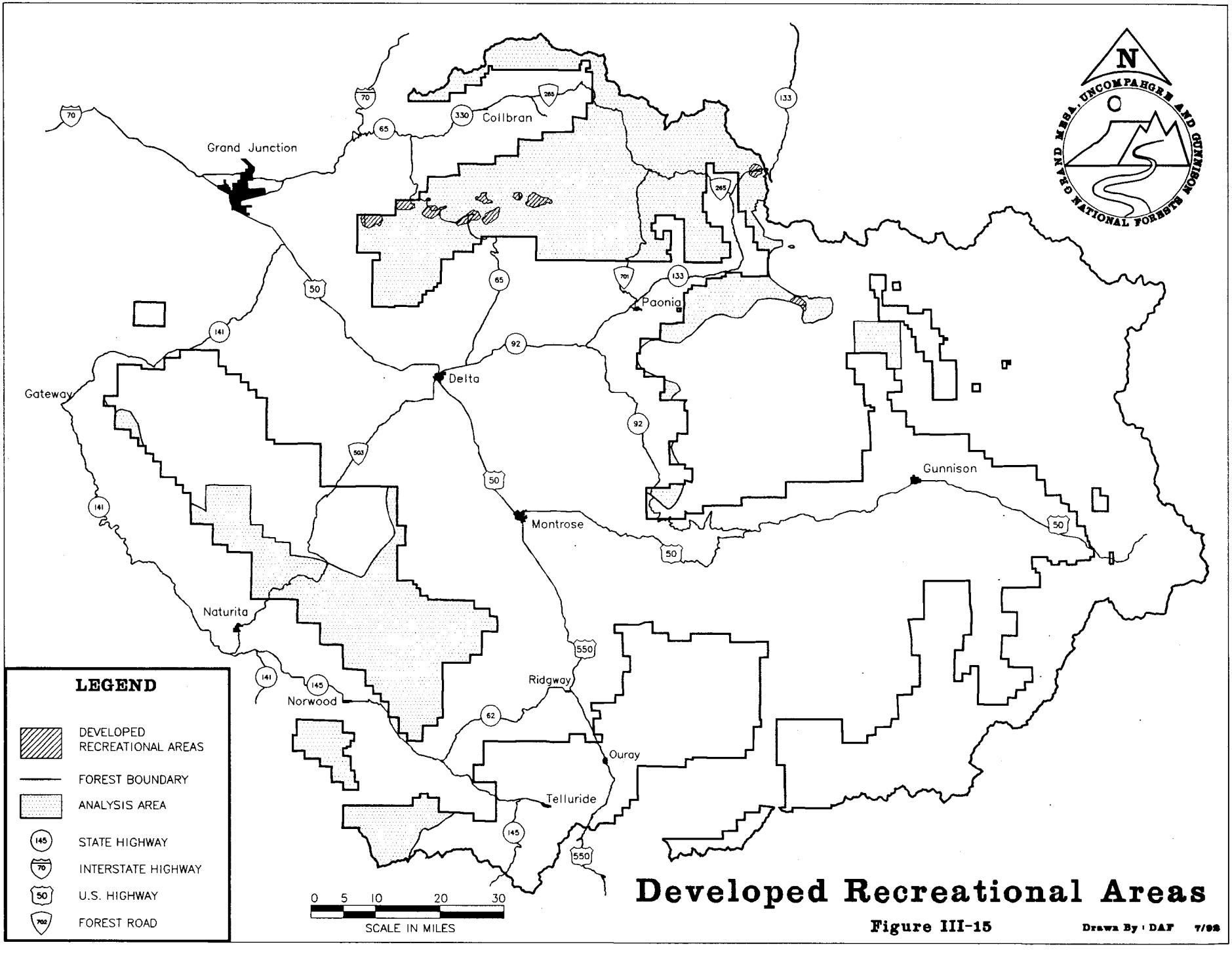
Drawn By : DAF 7/98



Semi-Primitive Non-Motorized (3A Management Areas)

Figure III-14

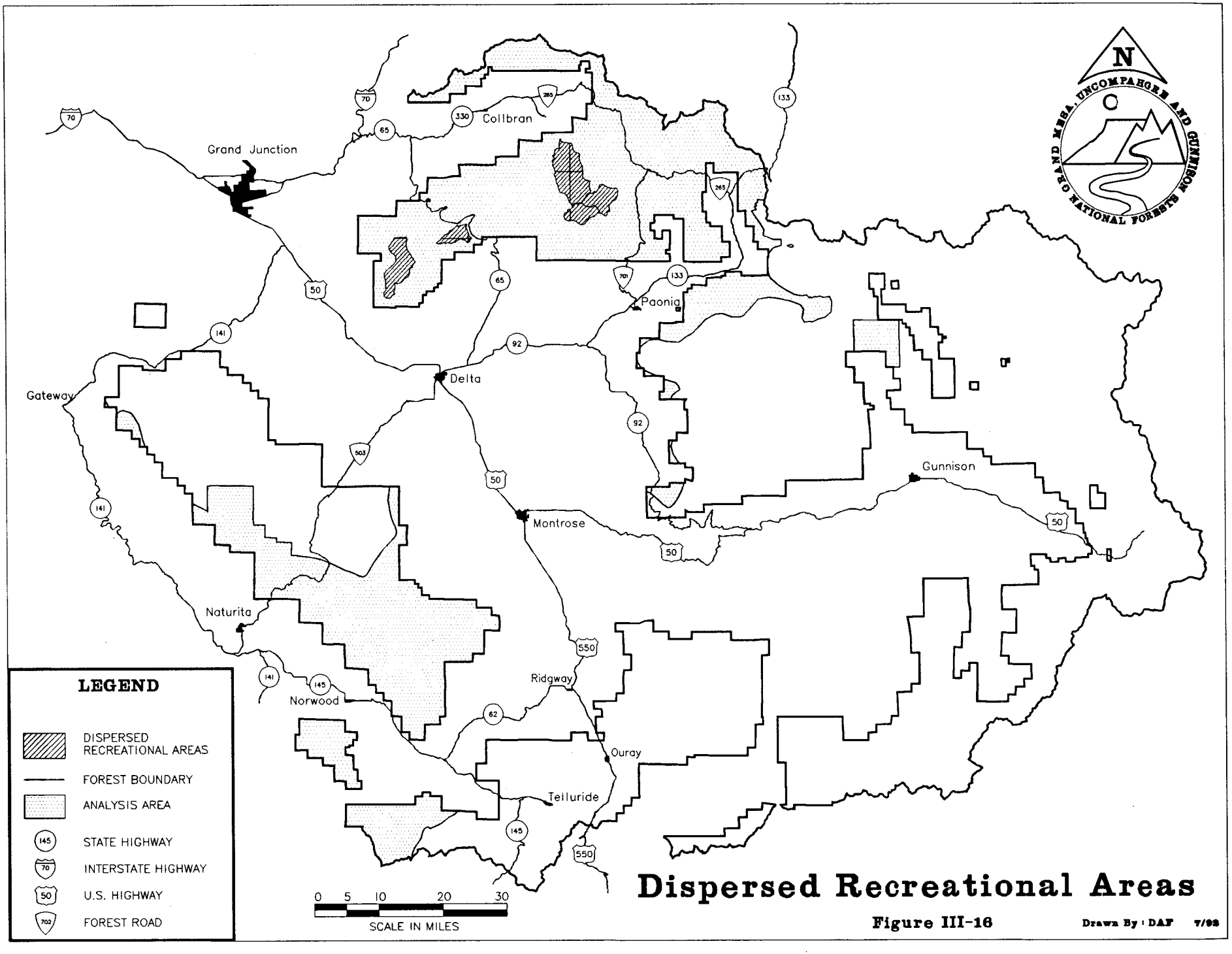
Drawn By : DAF 7/93



Developed Recreational Areas

Figure III-15

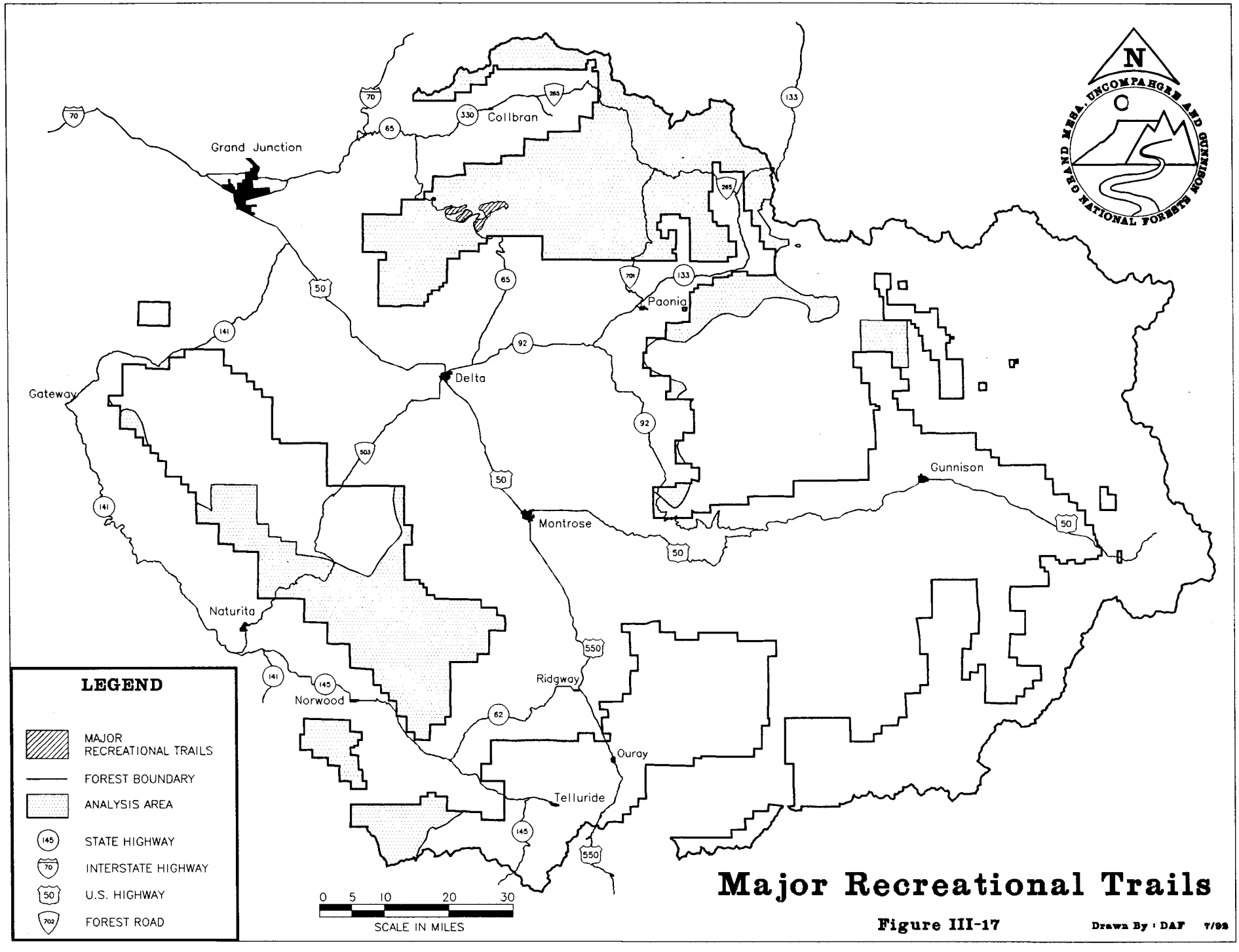
Drawn By : DAF 7/92



Dispersed Recreational Areas

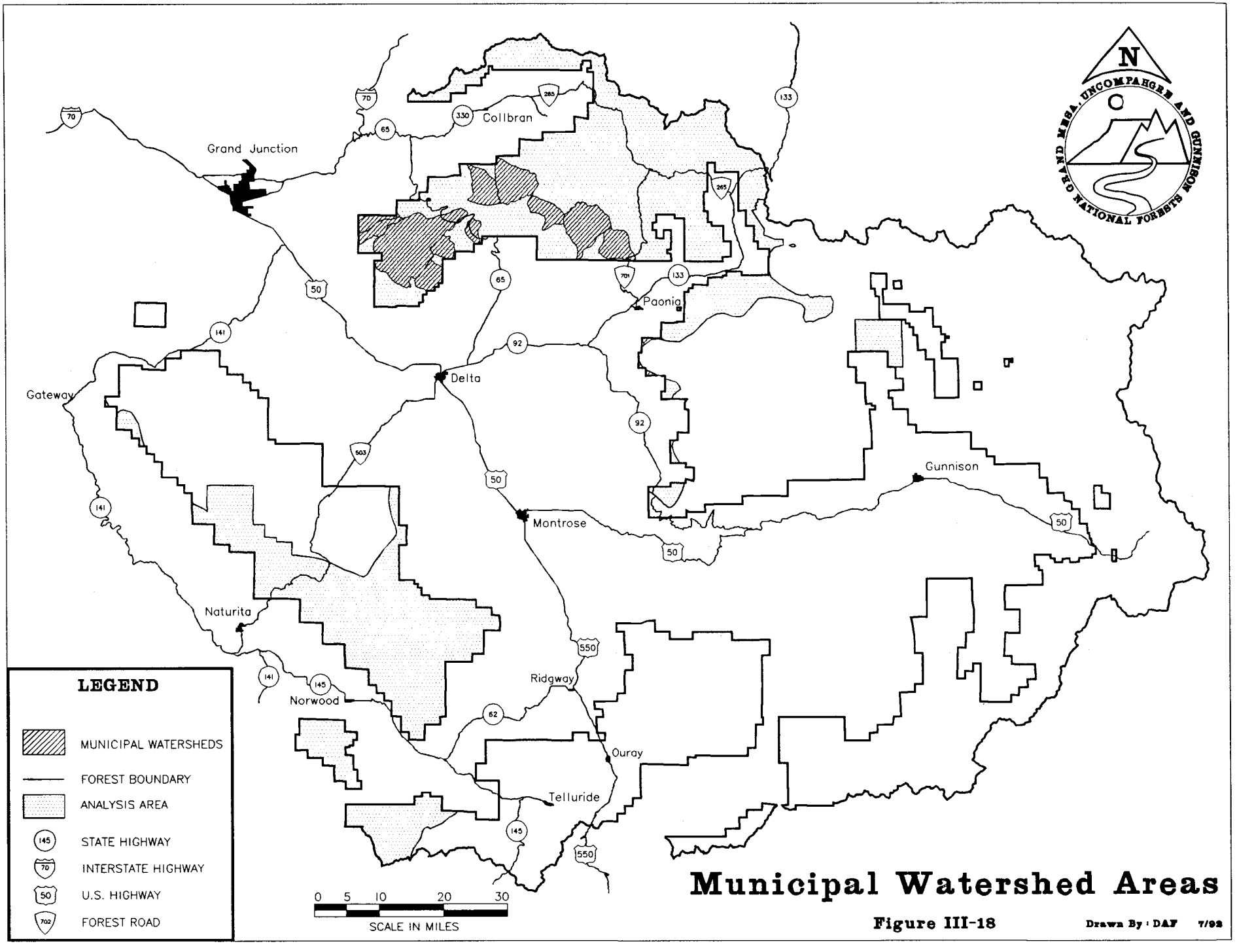
Figure III-16

Drawn By : DAF 7/93



Major Recreational Trails

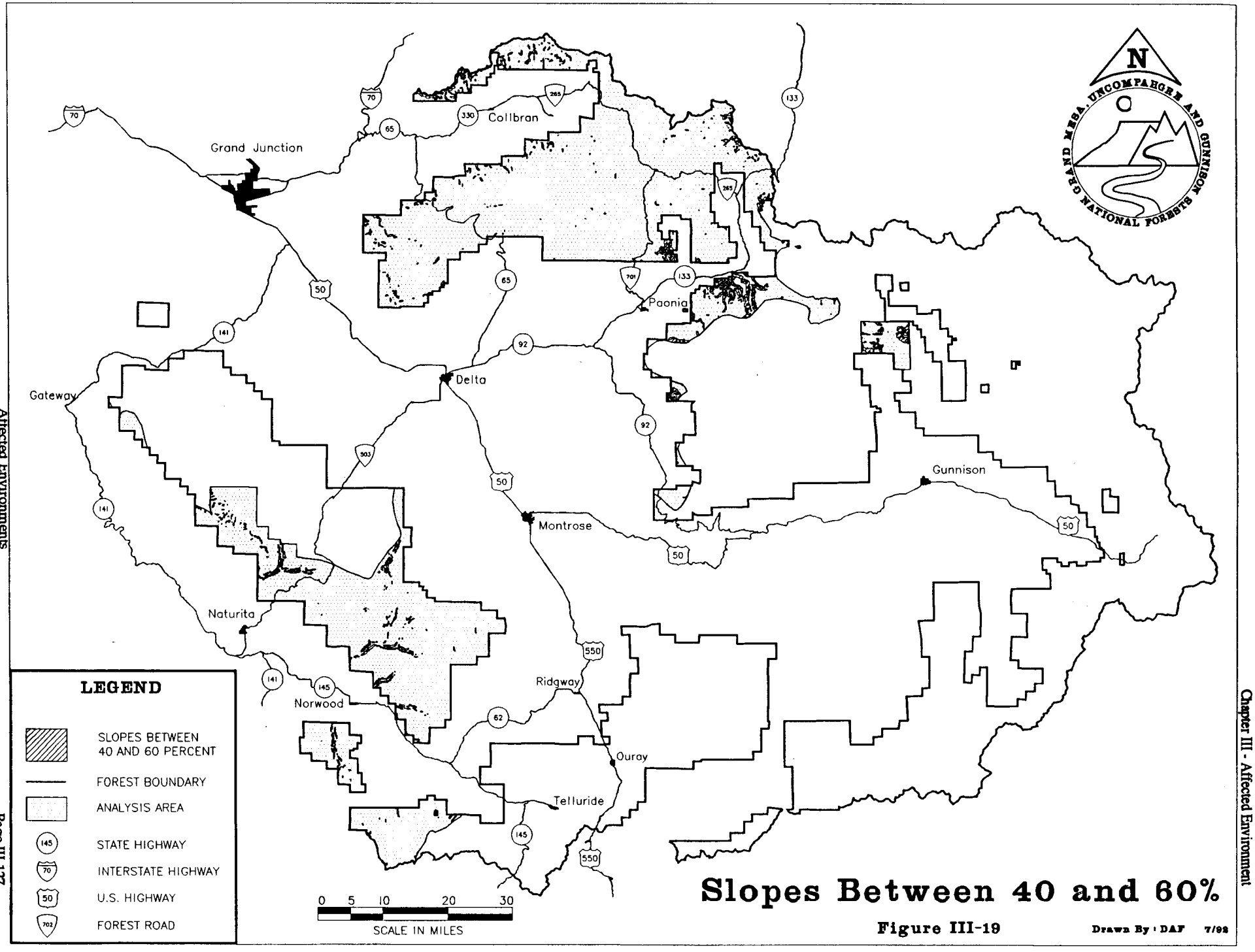
Figure III-17 Drawn By : DAF 7/93



Municipal Watershed Areas

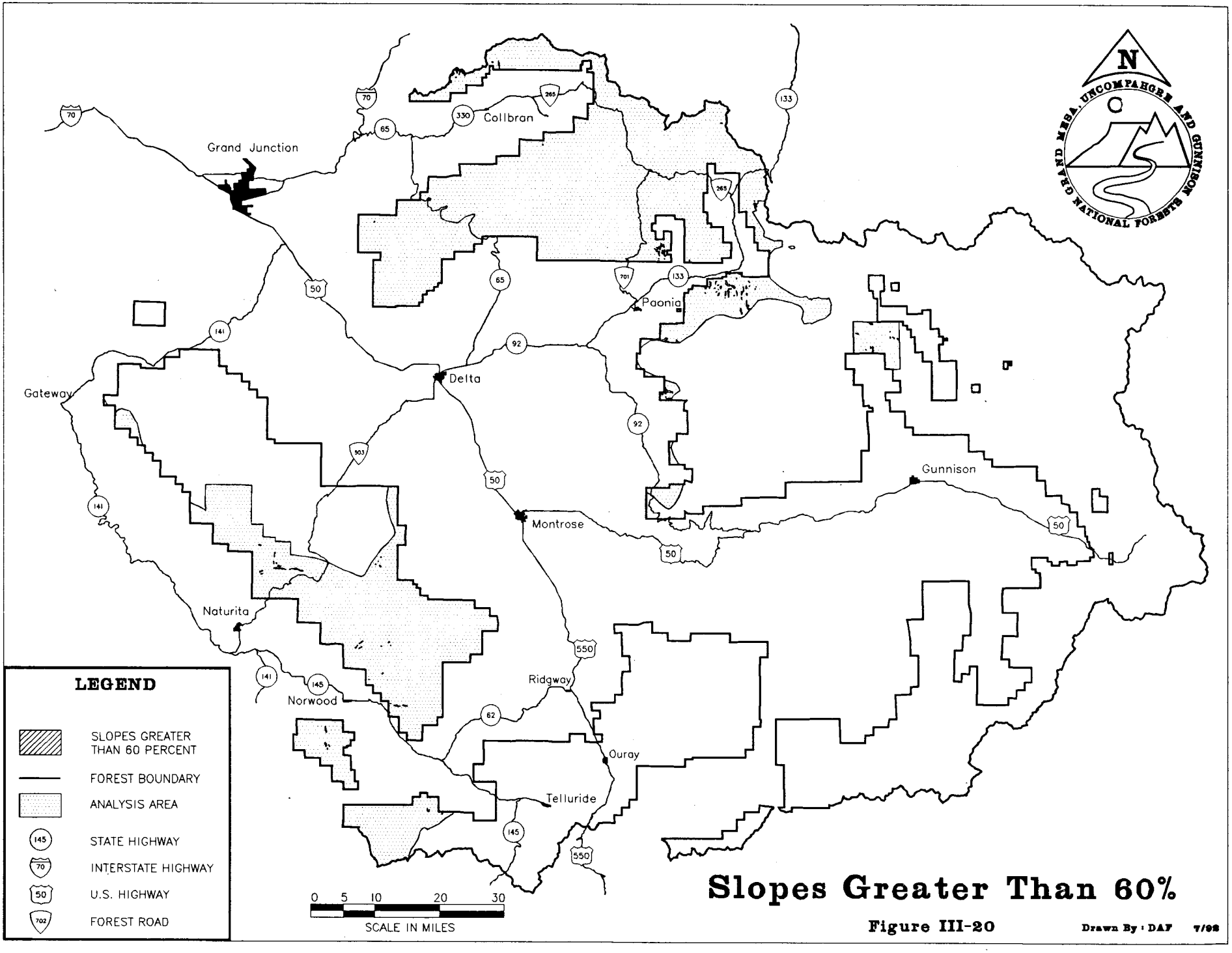
Figure III-18

Drawn By : DAF 7/92



Slopes Between 40 and 60%

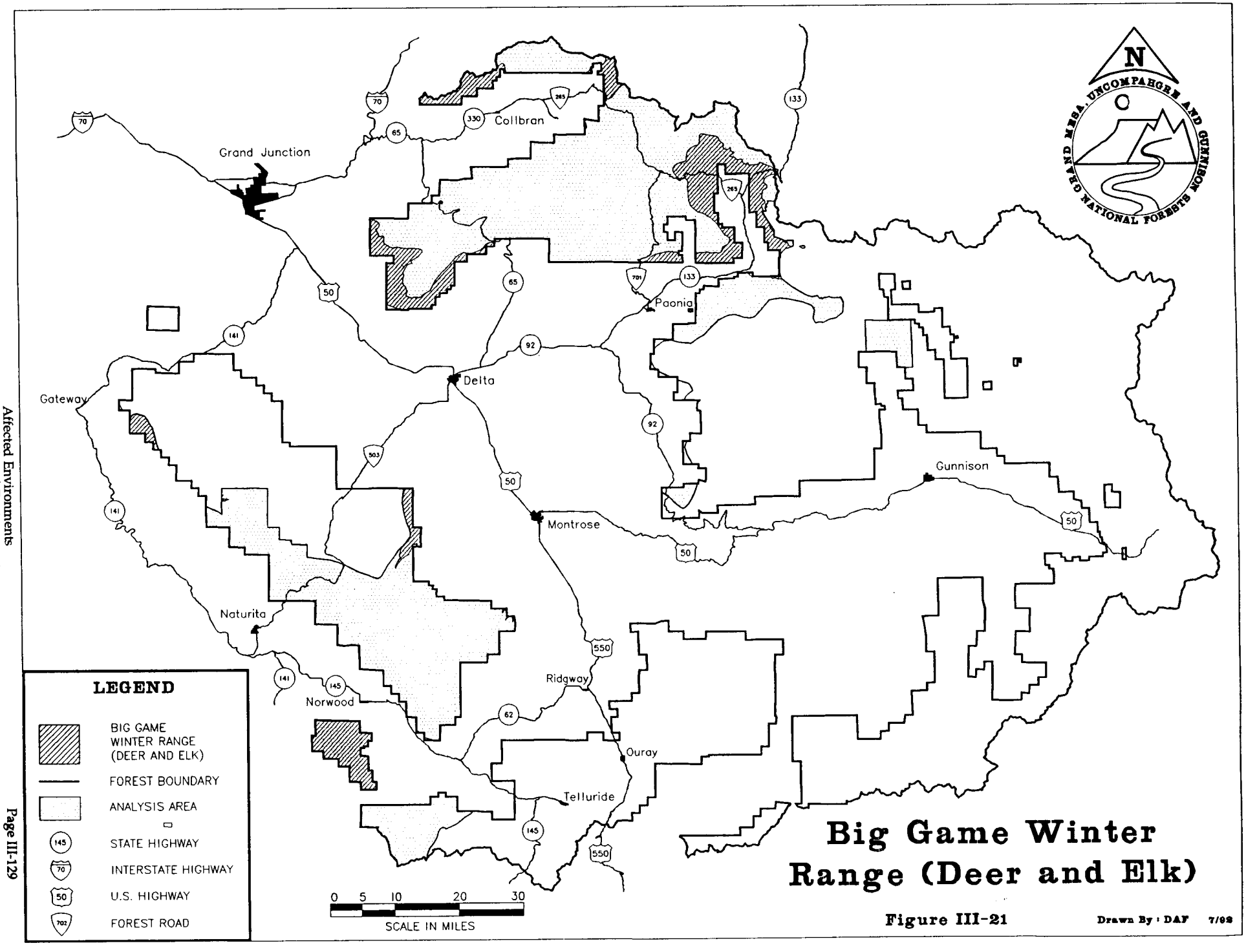
Figure III-19 Drawn By : DAF 7/92

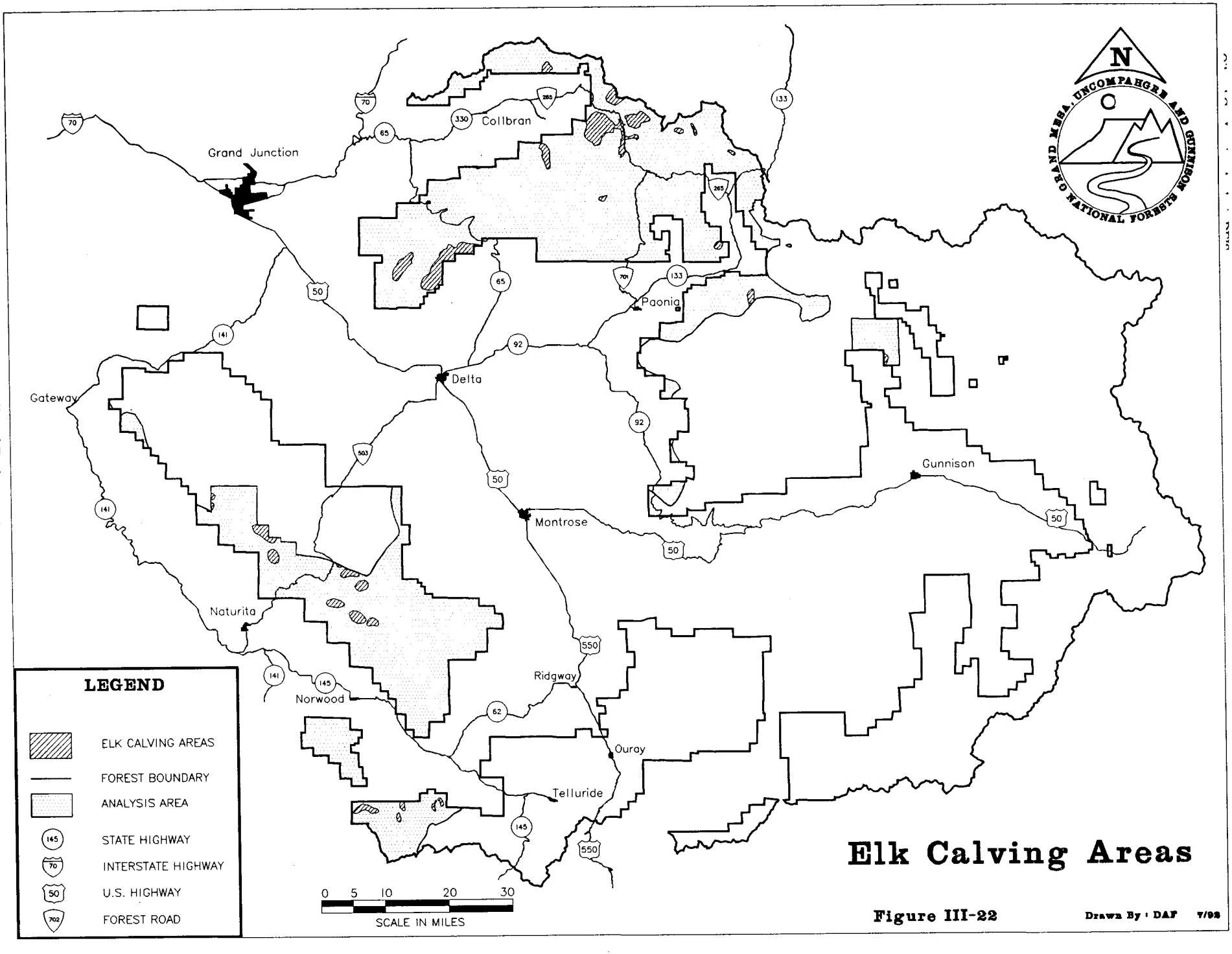


Slopes Greater Than 60%

Figure III-20

Drawn By : DAF 7/98


N
GRAND MESA, UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS
Grand Junction
Collbran
Paonia
Delta
Gateway
Montrose
Gunnison
Naturita
Norwood
Ridgway
Ouray
Telluride
LEGEND
BIG GAME WINTER RANGE (DEER AND ELK)
FOREST BOUNDARY
ANALYSIS AREA
STATE HIGHWAY
INTERSTATE HIGHWAY
U.S. HIGHWAY
FOREST ROAD
0 5 10 20 30
SCALE IN MILES
Big Game Winter Range (Deer and Elk)
Figure III-21
Drawn By : DAF 7/92



Elk Calving Areas

Figure III-22

Drawn By : DAF 7/93

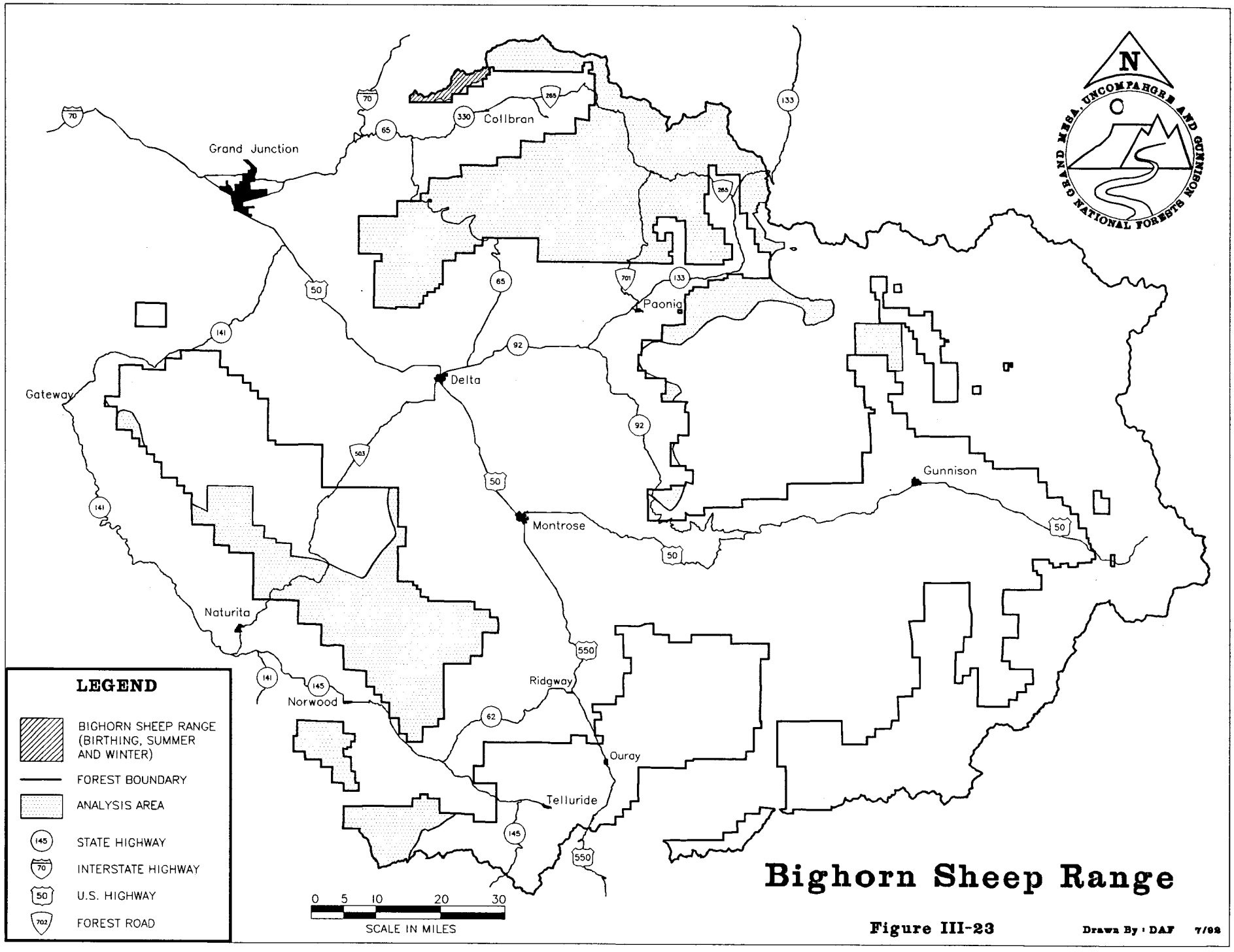
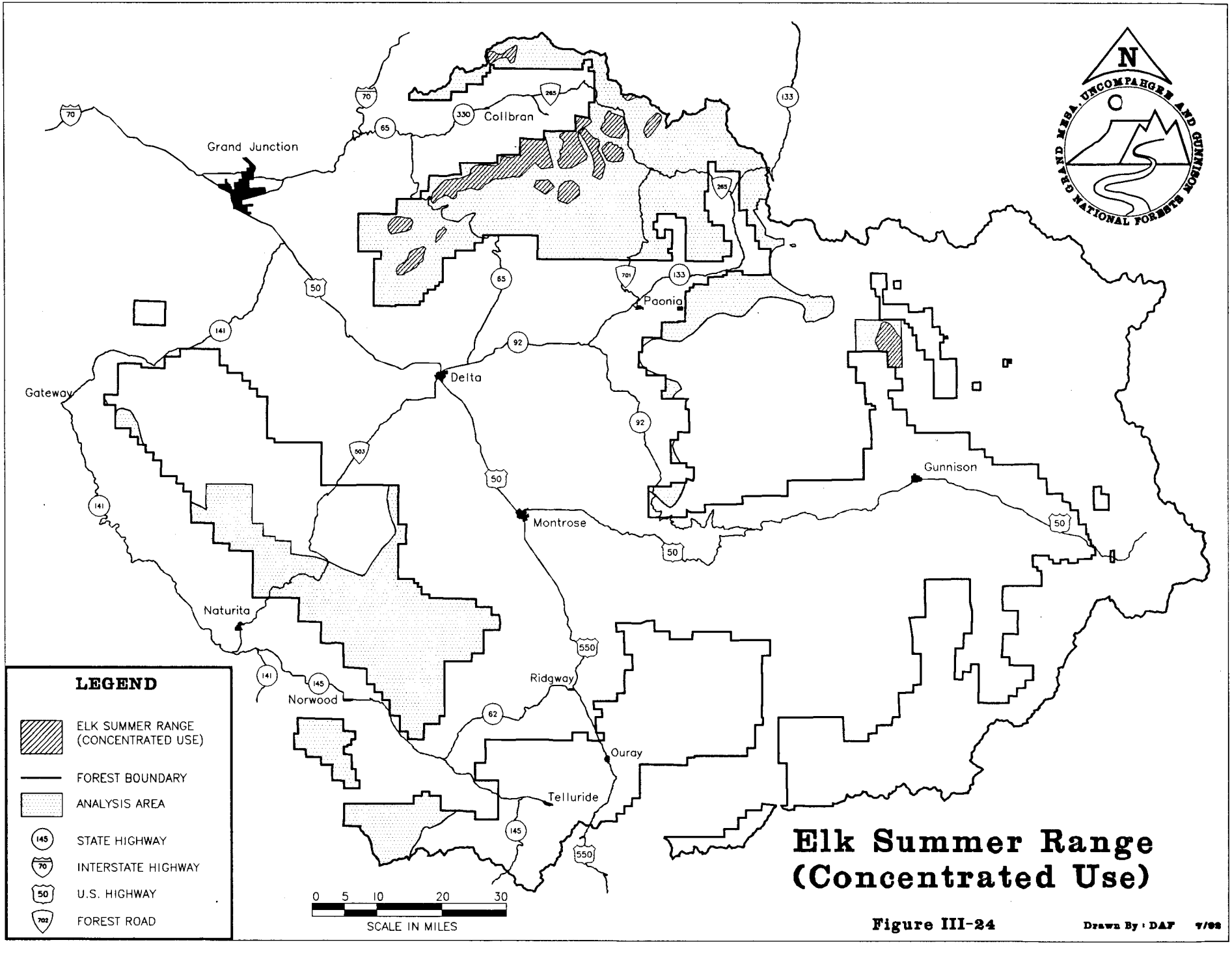


Figure III-23

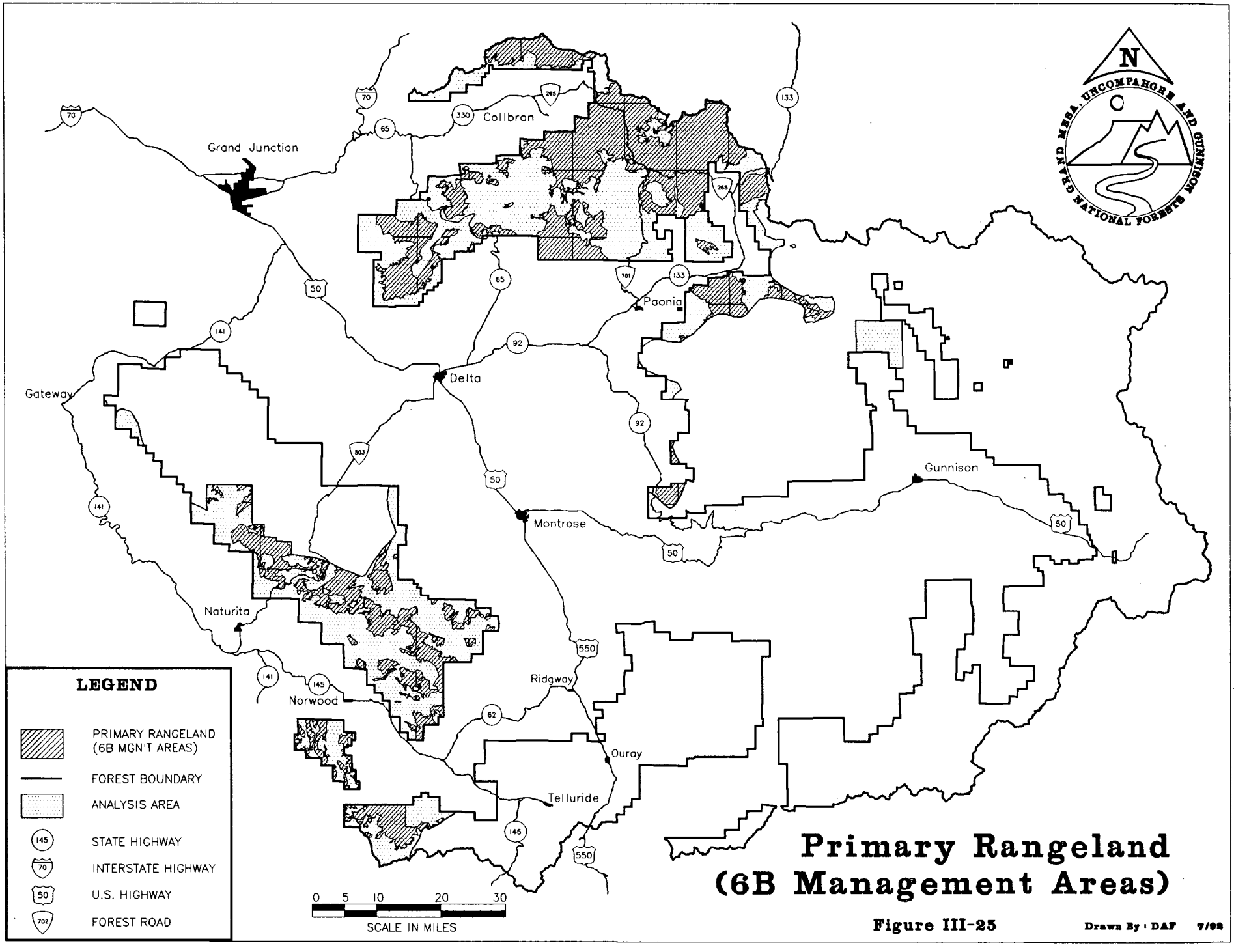
Drawn By : DAF 7/93



Elk Summer Range (Concentrated Use)

Figure III-24

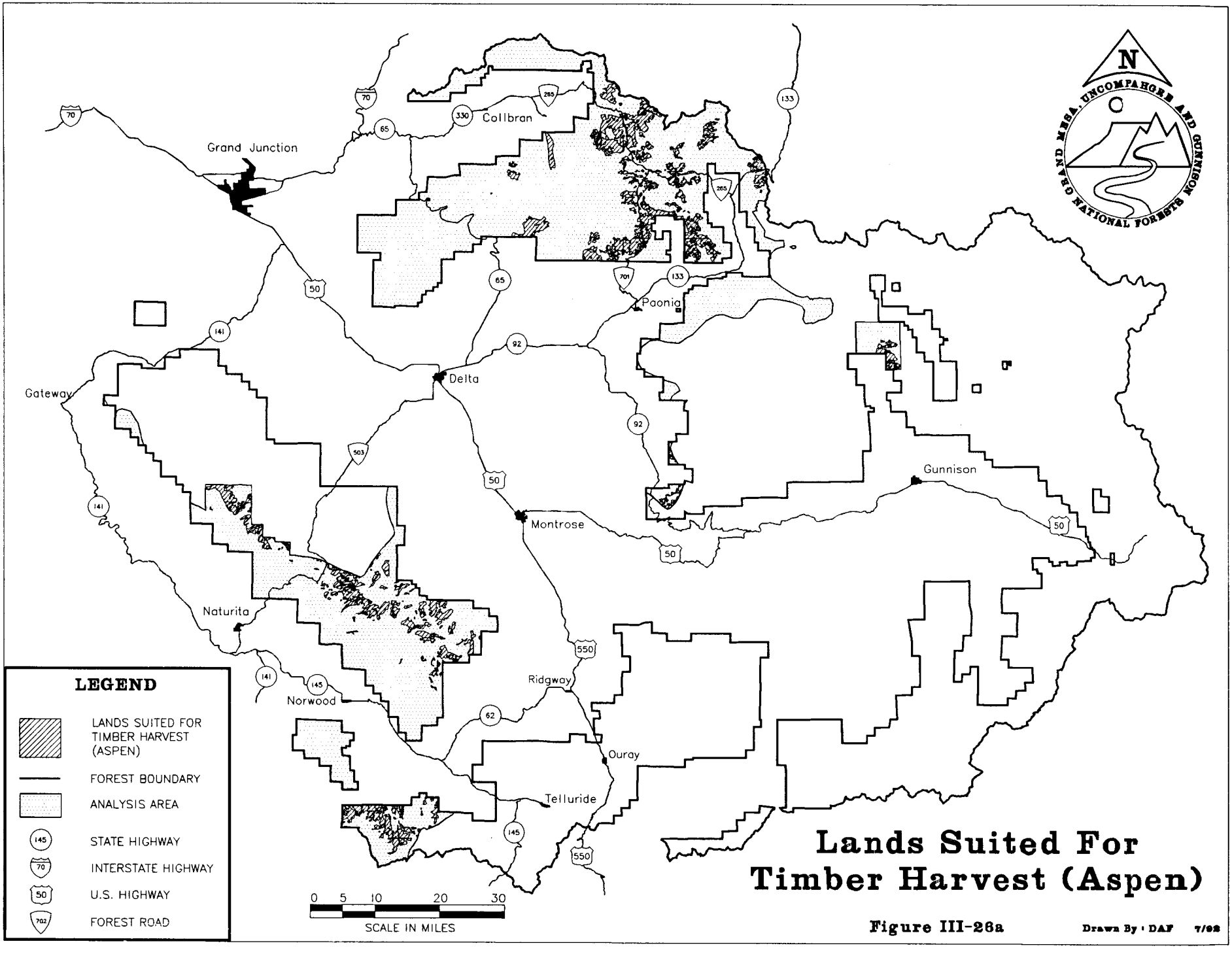
Drawn By : DAF 7/92



Primary Rangeland (6B Management Areas)

Figure III-25

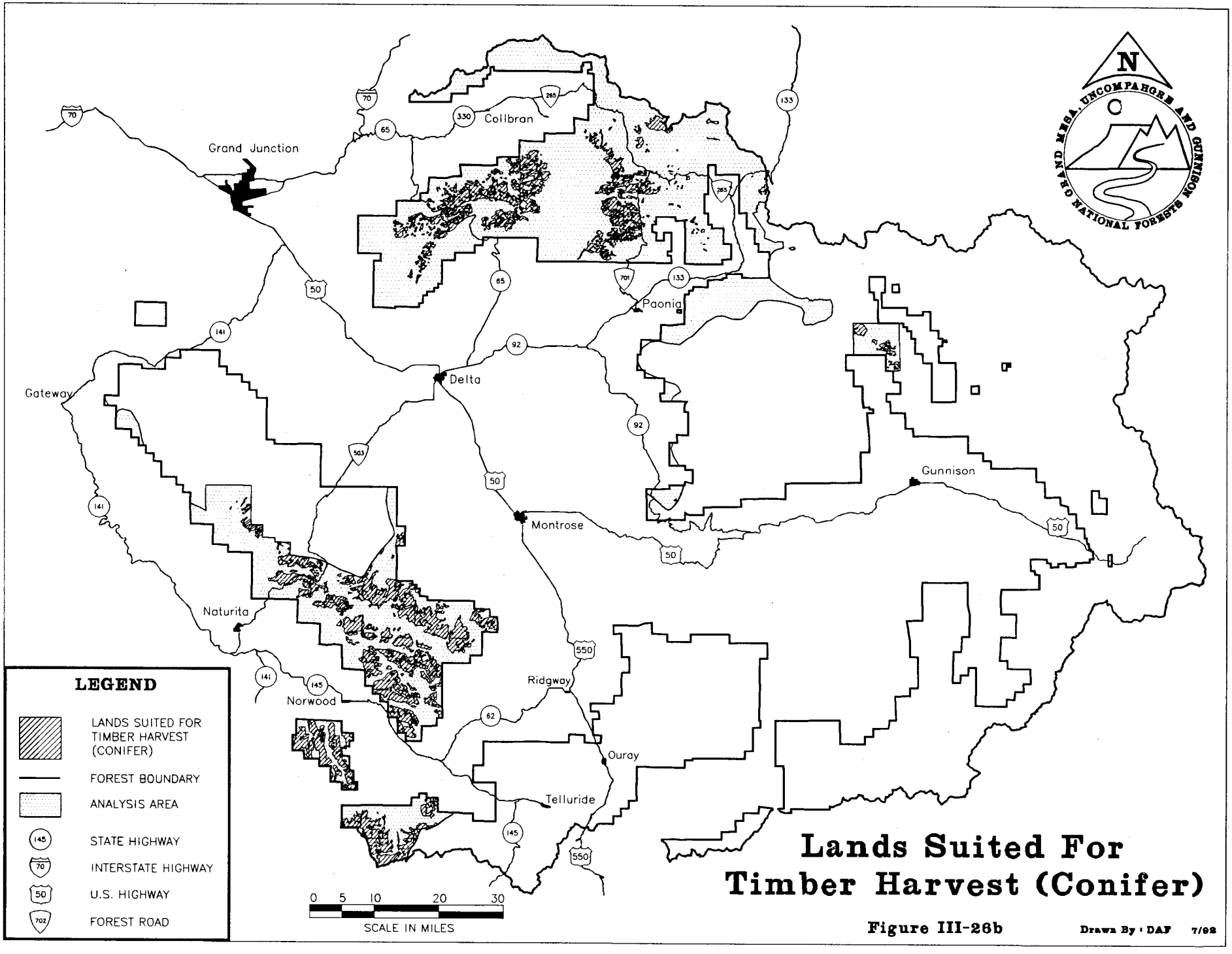
Drawn By : DAF 7/98

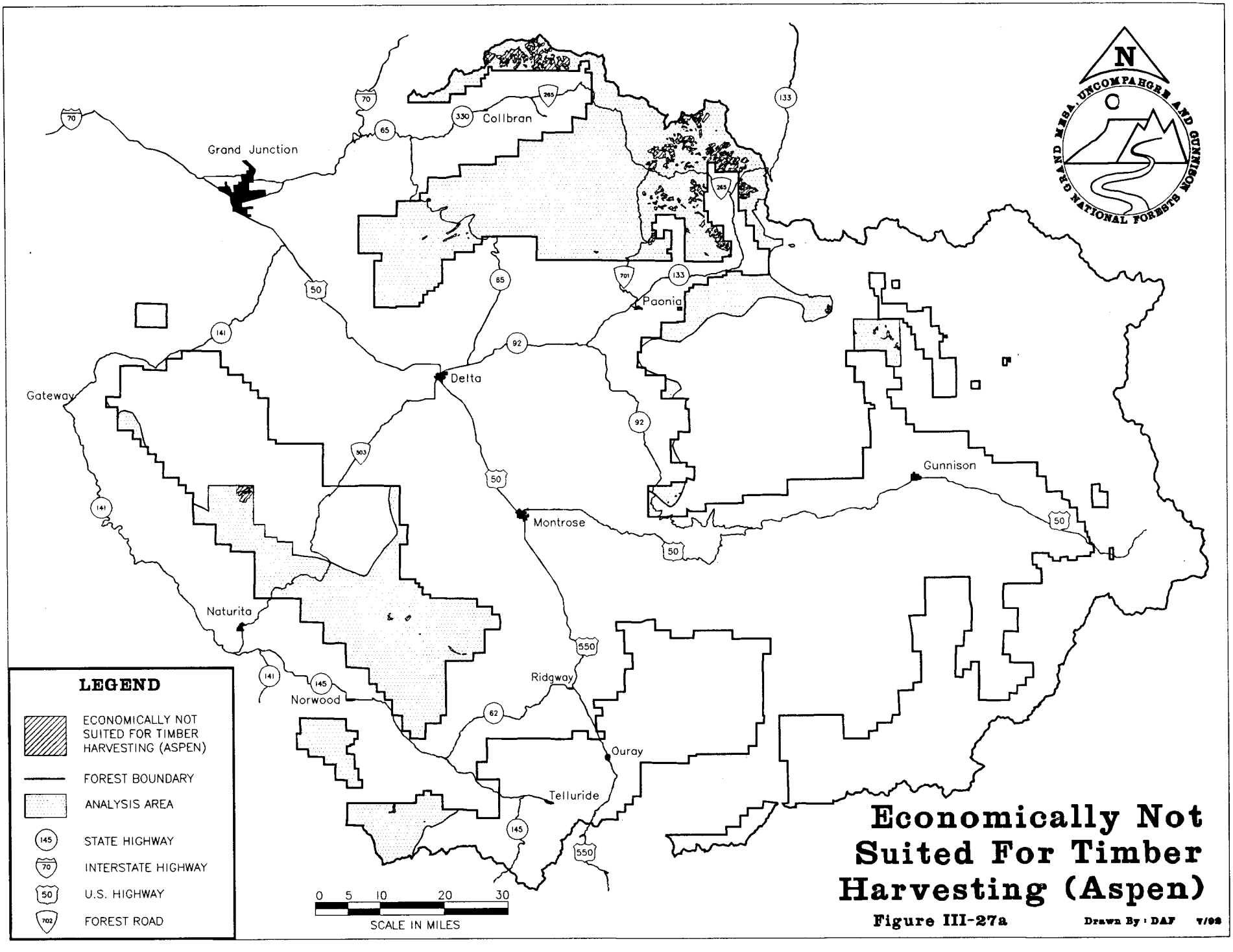


Lands Suited For Timber Harvest (Aspen)

Figure III-26a

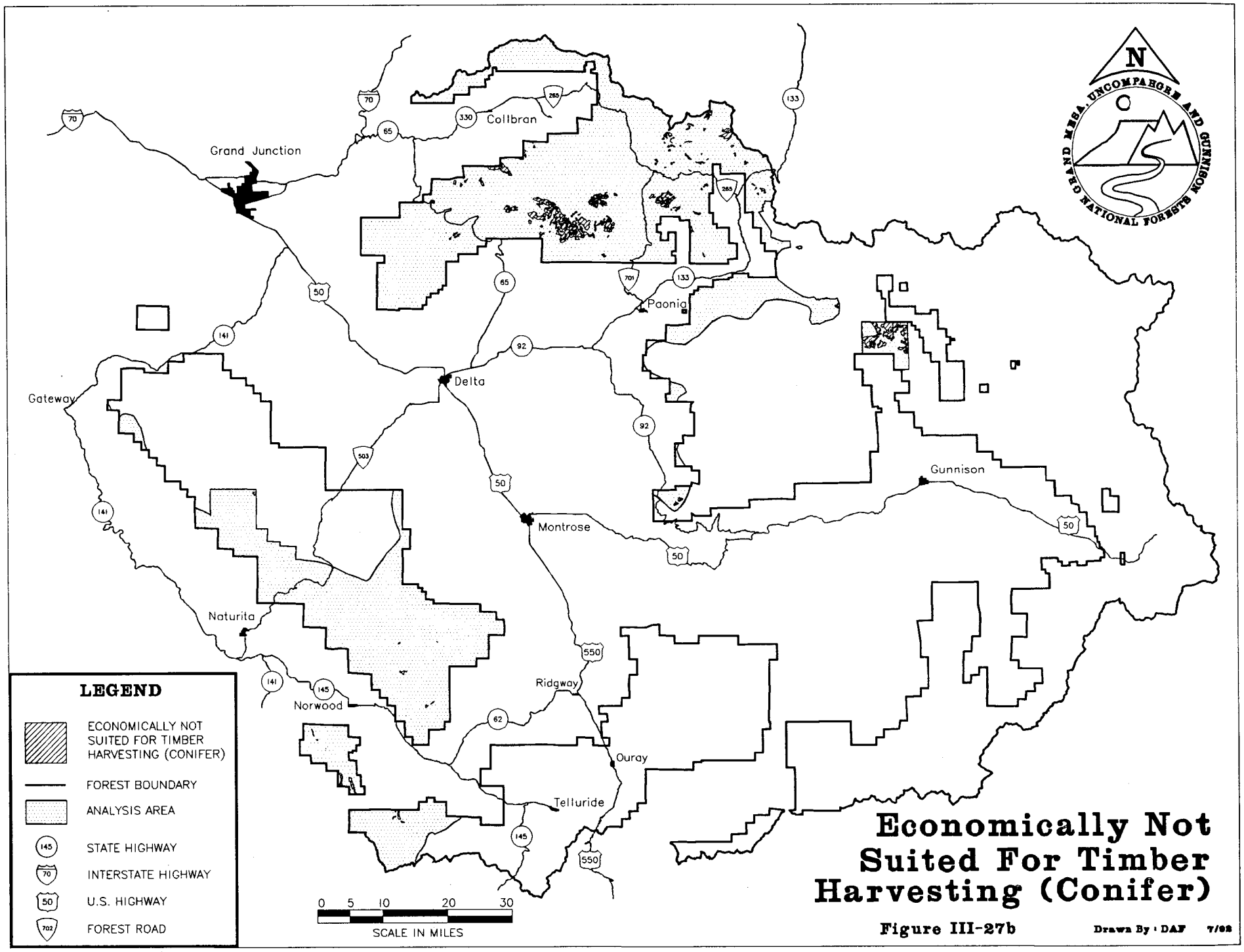
Drawn By : DAF 7/92


N
GRAND MESA, UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS
Grand Junction
Collbran
Paonia
Delta
Gateway
Gunnison
Montrose
Naturita
Norwood
Ridgway
Ouray
Telluride
LEGEND
LANDS SUITED FOR TIMBER HARVEST (CONIFER)
FOREST BOUNDARY
ANALYSIS AREA
STATE HIGHWAY
INTERSTATE HIGHWAY
U.S. HIGHWAY
FOREST ROAD
0 5 10 20 30
SCALE IN MILES
Lands Suited For Timber Harvest (Conifer)
Figure III-26b
Drawn By : DAF 7/92



Economically Not Suited For Timber Harvesting (Aspen)

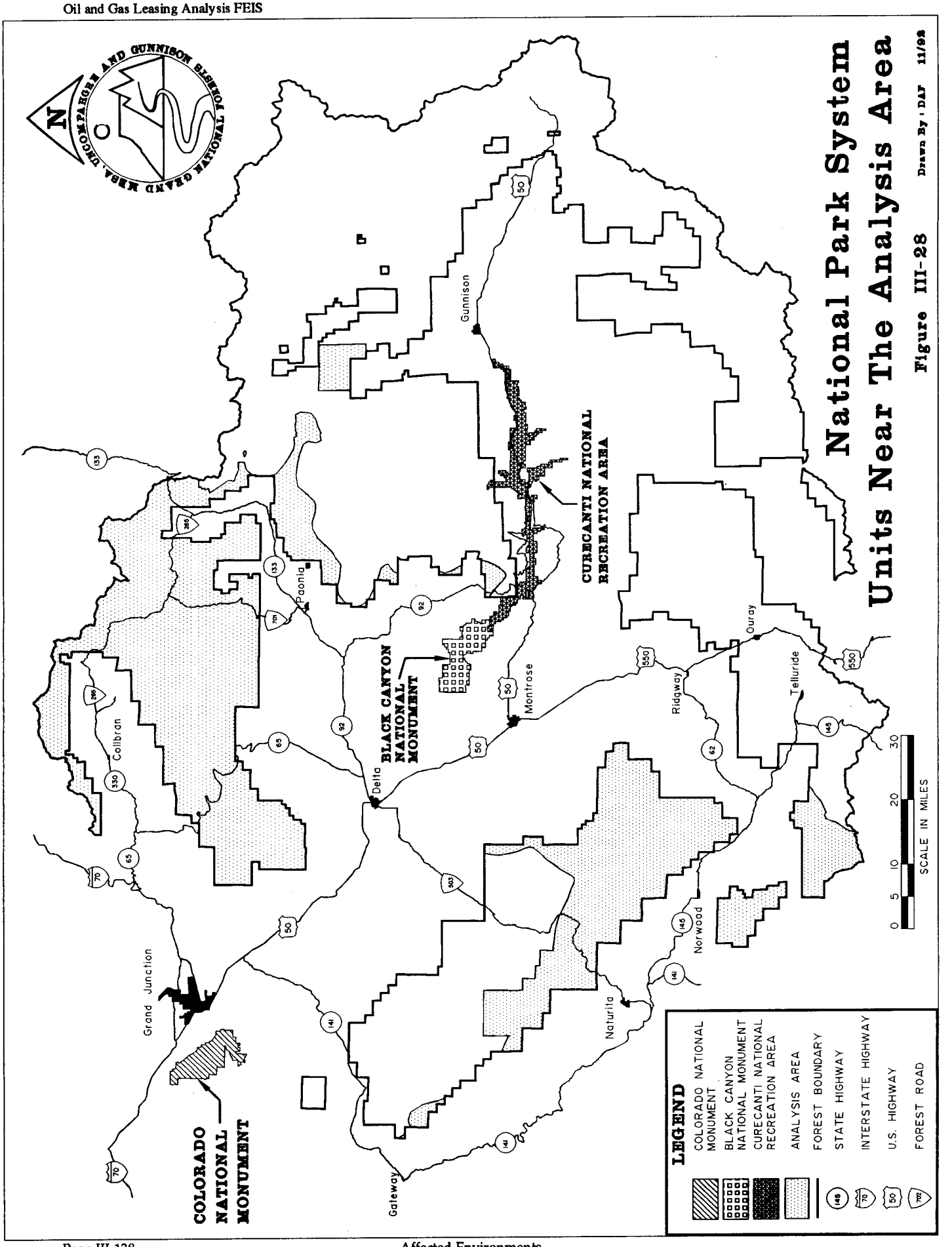
Figure III-27a Drawn By: DAF 7/98

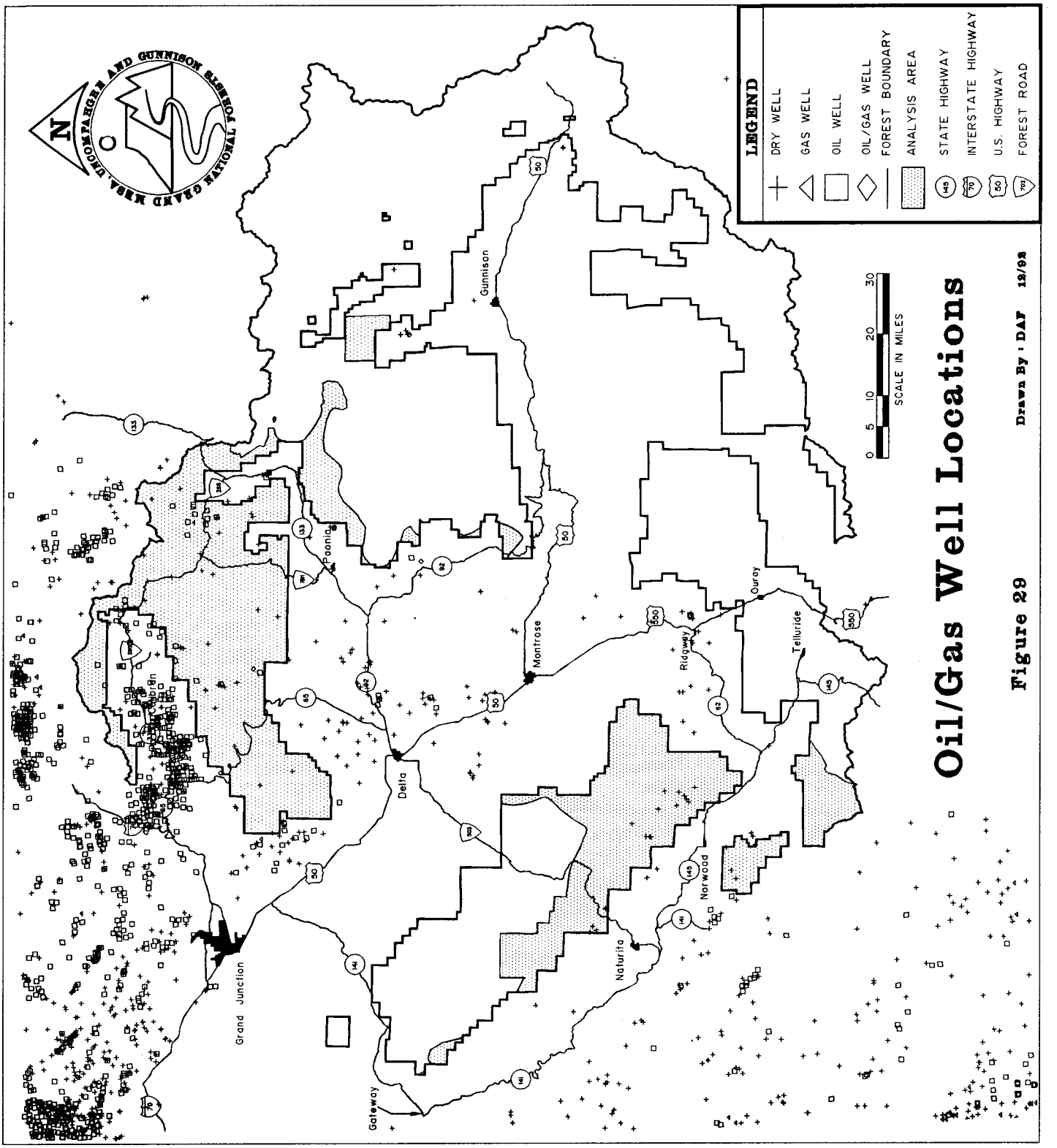


Economically Not Suited For Timber Harvesting (Conifer)

Figure III-27b

Drawn By : DAF 7/92


National Park System
Units Near The Analysis Area
Figure III-28
Drawn By: DAF 11/92
UNCOMPAHGRE AND GUNNISON FORESTS
GRAND MESA
N
COLORADO NATIONAL MONUMENT
BLACK CANYON NATIONAL MONUMENT
CURECANTI NATIONAL RECREATION AREA
Grand Junction
Collbran
Paonia
Delta
Gunnison
Montrose
Ouray
Ridgway
Telluride
Norwood
Naturita
Gateway
SCALE IN MILES
0 5 10 20 30
LEGEND
COLORADO NATIONAL MONUMENT
BLACK CANYON NATIONAL MONUMENT
CURECANTI NATIONAL RECREATION AREA
ANALYSIS AREA
FOREST BOUNDARY
STATE HIGHWAY
INTERSTATE HIGHWAY
U.S. HIGHWAY
FOREST ROAD


Oil/Gas Well Locations
Figure 29
Drawn By : DAF 12/92
LEGEND
DRY WELL
GAS WELL
OIL WELL
OIL/GAS WELL
FOREST BOUNDARY
ANALYSIS AREA
STATE HIGHWAY
INTERSTATE HIGHWAY
U.S. HIGHWAY
FOREST ROAD
SCALE IN MILES
0 5 10 20 30
GRAND MESA, UNCOMPAHGRE AND GUNNISON NATIONAL FORESTS
N
Gunnison
Montrose
Ouray
Ridgway
Telluride
Delta
Grand Junction
Gateway
Naturita
Norwood
Paonia

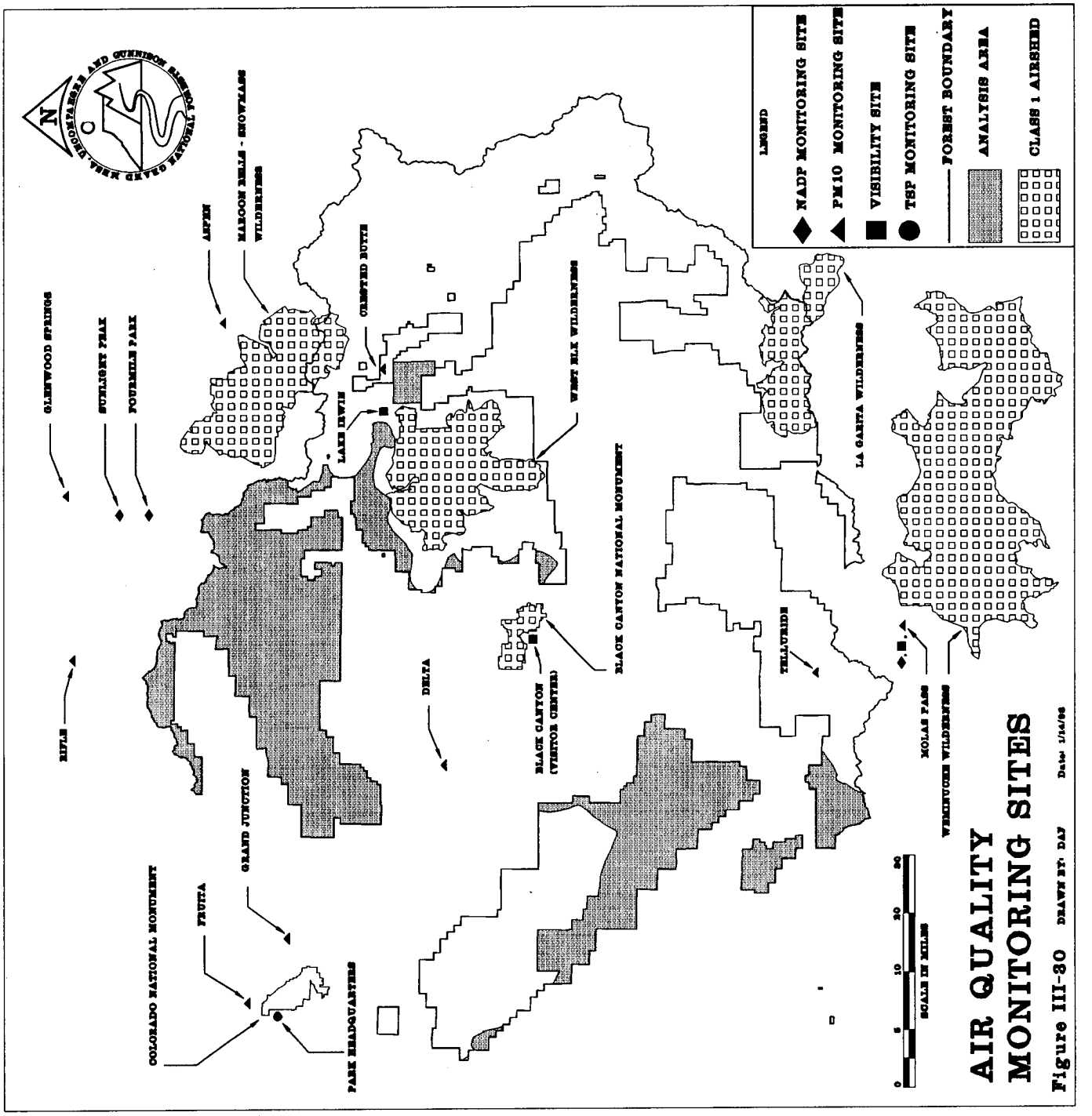

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Figure III-30
LEGEND
NADP MONITORING SITE
PM10 MONITORING SITE
VISIBILITY SITE
TSP MONITORING SITE
FOREST BOUNDARY
ANALYSIS AREA
CLASS 1 AIRSHED
GLENWOOD SPRINGS
SUNLIGHT PEAK
FOURMILE PARK
ASPEN
MAROON BELLS - SNOWMASS WILDERNESS
CRESTED BUTTE
LAKE IRWIN
WEST ELK WILDERNESS
LA GARITA WILDERNESS
BLACK CANYON NATIONAL MONUMENT
BLACK CANYON (VISITOR CENTER)
DELTA
TELLURIDE
MOLAS PASS
WEMINUCHE WILDERNESS
RIFLE
GRAND JUNCTION
COLORADO NATIONAL MONUMENT
FRUITA
PARK HEADQUARTERS
SCALE IN MILES

Chapter IV - Environmental Consequences

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Chapter IV - Environmental Consequences

Introduction

This chapter describes the estimated effects of selecting each of the lease options and program alternatives as presented in Chapter II. The environmental consequences of the lease options on each of the *Affected Environments* is discussed, followed by a discussion of the overall environmental consequences of choosing a program alternative.

Impacts of a Lease

The authorization of a lease does not, in itself, create any environmental effects. However, authorization implies that oil and gas exploration and development may take place at a future time. The Forest Service oil and gas regulations direct us to consider the subsequent actions which would be authorized by a lease, and their potential environmental effects, as *connected actions*. This includes the Reasonably Foreseeable Development scenario and the activities described in Appendix E. These actions also meet the definition of connected actions in the procedural requirements for the National Environmental Policy Act (40 CFR 1502).

These expected actions are the basis of the environmental analysis from which the leasing decisions will be made. The decision on the lands that will be administratively available, and the subsequent decision authorizing leases, are based upon analysis of the likely environmental effects of the connected actions.

Environmental Consequences of Lease Options

General Forest

This section describes the environmental consequences of lease options in the General Forest. For an understanding of the overall organization of this chapter, refer to the description of the analysis process in Chapter I.

Environmental Factor: Biological Diversity

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no increased impacts to biological diversity. Opportunities to create biological diversity through vegetative manipulation and the location of oil and gas facilities would be lost.

Controlled Surface Use, Timing Limitations, and Standard Lease Terms: *Controlled Surface Use, Timing Limitations,* and *Standard Lease Terms* would result in similar impacts to biological diversity. Temporary loss of biodiversity may result on sites cleared for roads, drill pads, and pipelines. Road and drill pad cut and fill slopes and pipeline corridors would probably be revegetated with grass species. Trees would be missing from these sites until early successional species are established. Indirectly, areas made viable for timber sales because of access provided by the oil and gas activity, could suffer some loss in biodiversity as a result of timber management activity.

Environmental Factor: Vegetation

No Lease: *No Lease* would result in no change to the coniferous or deciduous forest environment. The aspen areas classified in the Forest Plan as appropriate suited lands which are currently not managed due to high road system cost, would remain in the natural state. Management on these areas for wood fiber production, wildlife habitat, visual quality, plant and animal diversity, and control of insects, disease and wildfire would continue to be curtailed.

Conflicts between the public, timber purchasers, and oil and gas operators regarding road use and maintenance would not arise in areas which are *No Lease*.

No Surface Occupancy: *No Surface Occupancy* may result in some small change to the aspen environment. When an area of *No Surface Occupancy* lies adjacent to an area other than *No Lease*, the viability of vegetation management activities may be effected if a road system is designed in the adjacent area. An area which is classified in the Forest Plan as appropriate suited land which is currently not managed due to high road system cost, may become economically viable. The restrictions of *No Surface Occupancy* for oil and gas activity may not preclude vegetation management activity. If such a scenario develops, additional effects listed in the alternatives with stipulations or *Standard Lease Terms* would apply. Coniferous species are unaffected by this type of land classification change. Lands suited for timber harvest may become more viable for vegetation management activities, due to a more extensive road system.

Controlled Surface Use, Timing Limitations, and Standard Lease Terms: *Controlled Surface Use*, *Timing Limitations*, and *Standard Lease Terms* may result in a change to the aspen environment. Areas which are classified in the Forest Plan as appropriate suited lands which are currently not managed due to high road system cost, may have a road system developed which may make the area economically viable. Any activity within this land classification may increase the Allowable Sale Quantity (ASQ), slightly (would first require environmental analysis and a Forest Plan amendment). Management for wood fiber production, wildlife habitat, visual quality, plant and animal diversity, and control of insects, disease, and wildfire can occur. Generally, coniferous species are unaffected by this type of land classification change. Lands suited for timber harvest may become more viable for vegetation management activities due to a more extensive road system.

Conflicts between the public, timber purchasers, and oil and gas operators regarding road use and maintenance would arise in areas where coincidental activities occur during oil and gas development. Lands which are in timber sales or other vegetation management contracts may also be under an oil and gas lease. Conflicts would occur with coincident operations relating to such aspects as harvest, hauling, road building, and timing of operations.

Vegetation removed for roads, drill pads, and well sites would be temporarily out of production for wood fiber, wildlife habitat, and plant and animal diversity.

Old Growth Timber Stands

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no adverse impacts on "old growth" timber stands.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: *Controlled Surface Use*, *Timing Limitations*, and *Standard Lease Terms* would result in similar impacts to "old growth" timber stands. Any removal of timber for road, well pad, or pipeline construction would result in a net loss of "old growth" timber. The resultant loss of "old growth" would result in loss of habitat for those species dependent on "old growth" timber stands.

Environmental Factor: Soils

Oil and gas exploration and development activities heavily impact the soil resource. When activities such as clearing, leveling, scraping, and shaping are conducted with heavy machinery, the soil resource is obviously impacted. The soil mantle is cut into, displaced, mixed, spread, and reworked as needed to make the area suitable for the facility (road, drill pad, or pipeline) under construction. The result is that the natural equilibrium that a soil had with its setting is irreversibly altered. Physical soil characteristics that are altered by these activities are: the layering sequence of soil, the natural soil structure density, the soil's porosity, infiltration and permeability rates, internal shear strength, water holding capacities, organic matter distribution, and soil water flow characteristics. The soil also has trillions of organisms and micro-organisms per cubic yard. With large disturbances, these organisms are disrupted or destroyed, depending on the disturbance and the organism. Along with these impacts, construction activities remove protective vegetative and duff layers, and expose mineral soil to the forces of erosion (i.e., all forms of erosion: sheet, rill, gully, slumping and earthflows). With new construction of roads and related areas, it is not uncommon to increase the rate of erosion 80-100 times the natural rate.

The overall impact activities associated with oil and gas exploration and development would have on the soil depends on the type, magnitude, nature and duration of the disturbance, along with the individual soil characteristics of a particular site.

Soils are discussed further in those *Affected Environments* that have sensitive soils, such as "Aquatic/Riparian/Wetland Habitats", "Alpine/Tundra Areas", "Slopes 40-60%" and "Slopes >60%".

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would prevent new impacts to the soil resource in the general forest soil areas. There would be no new land areas pulled out of production or subject to reduced production levels as as result of construction disturbances.

Controlled Surface Use: With the *Controlled Surface Use* option, oil and gas activities would be allowed, but only with prescribed mitigation measures or control measures. Excessive soil resource damage would occur if activities are conducted without special measures. The mitigation described (Appendix H) to protect the soil resource would lessen the impacts to the soil resource, as described below under *Standard Lease Terms.*

Timing Limitations: *Timing Limitations* would limit oil and gas construction activities during certain times of the year. Certain soils within the analysis area are especially susceptible to detrimental impacts of heavy equipment traffic and construction activities when saturated and at optimum soil moisture content for compaction. This situation occurs during spring and early summer snow melt periods and during long rainy spells in the summer. Unsurfaced roads are extremely susceptible to deep rutting and detrimental displacement and puddling during these periods. This may lead to hazardous situations for equipment and personnel. Under saturated conditions the soil is subject to accelerated erosion and easily washes off site as sediment. Construction activities and travel on unsurfaced roads would be controlled when the soils are saturated. *Timing Limitations* at the appropriate time of the year would result in lessened impacts to the soil resource and associated resources such as water and those plants and animals dependent on Aquatic habitats.

Standard Lease Terms: *Standard Lease Terms* would result in the potential for the adverse affects described above in the introduction to the environmental consequences for the soil resource. Road, well pad, and pipeline construction activities would result in displacement and mixing of soils and consequent loss of the natural soil profile, microorganisms, and irreversible loss of soil productivity. Soils exposed would be subject to increased erosion rates and potential transportation to streams. However, the General Forest environment is located sufficiently distant from water courses that sediment should not readily enter streams. The operator would be required to conduct his operations and apply reasonable mitigation measures to minimize adverse soil impacts. Reasonable and prudent

measures to protect the soil resource are found in Megahan, 1977; USDA Forest Service, 1990; and Burroughs and King, 1989.

Environmental Factor: Air Quality

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect on the air quality of an area.

Controlled Surface Use: *Controlled Surface Use,* such as not allowing the operator to pile and burn slash associated with road, well pad, or pipeline construction would mitigate air quality impacts. Dust abatement would lessen impacts from traffic on unpaved roads.

Timing Limitations: *Timing Limitations* requiring the operator to burn construction related slash during certain times of the year or under certain atmospheric conditions would lessen potential air quality impacts.

Standard Lease Terms: *Standard Lease Terms* would result in potential air quality impacts associated with burning slash, dust from traffic on unpaved roads, and construction of roads, well pads, and pipelines.

Environmental Factor: Water Quality and Quantity

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional oil and gas activities occurring. In most cases, no activity corresponds to no effect on water quality. However, oil and gas activities may represent an opportunity to correct existing water quality problems. This would most likely occur as a result of upgrading an existing road that is contributing to water quality degradation. The upgrading may involve improvement by installing proper drainage, revegetation of cuts and fills, and surfacing. Or it may involve relocating and rehabilitating a poorly located road. In this instance, *No Lease* would result in a lost opportunity to correct an existing problem.

Controlled Surface Use: Since the General Forest environment excludes all the high risk areas or areas that are of special concern regarding water quality, such as Riparian areas and Wetlands, water quality degradation would not be likely to occur. However, any ground disturbance carries a risk of impacting water quality. Applying a *Controlled Surface Use* stipulation would reduce the already low risk. For example, restricting off-road vehicle use, maintaining buffers between all surface drainage features, stringent reclamation standards, requirements to surface all roads, design of drilling operations, and special guidelines for handling and transporting hazardous substances would all contribute to lessening the potential for adverse water quality impacts.

Timing Limitation: *Timing Limitations* would reduce impacts by restricting activities to certain times of the year. Sediment is the greatest concern associated with ground disturbance. Erosion and sediment problems are greatest during the wet seasons when the ground is soft and water is available to transport disturbed material. Sediment contributions would be reduced by restricting construction and use activities on roads and well pads during the wet seasons, which is typically late fall and spring.

Standard Lease Terms: *Standard Lease Terms* would result in the greatest potential for impact to water quality. However, for the General Forest environment, impacts to water quality are not expected to be great for oil and gas activities operating under the *Standard Lease Terms*. Sediment is the primary concern and the General Forest environment is not expected to be a significant contributor of sediment. The General Forest environment is located sufficiently distant from water courses that sediment and spills of toxic substances should not readily enter streams.

Environmental Factor: Range and Livestock Grazing

Range and livestock grazing is covered as a separate *Affected Environment*. See Primary Rangelands on pages IV-37 through IV-38 of this chapter.

Environmental Factor: Roads

Road use is not typically subject to the lease options as described in this FEIS, except where road use would need to be controlled to protect the road, a capital investment, from damage. Road location and design are determined by lease options applied to resources like soils, water quality and wildlife habitat. However, many of the Forest roads have not been built to an all-weather standard. In other words, roads not built to adequately support the traffic loads associated with oil and gas activities may be closed during certain critical times of the year, such as the spring thaw, to prevent damage to the road. As an alternative to a seasonal shut-down, the operator may be allowed to build or reconstruct the road to an all-season standard. The specific road system requirements in addition to those discussed under mitigation (Appendix H) will be identified at the time of an APD.

Environmental Factor: Visual Resources

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no net change to visual resources in the General Forest environment.

Controlled Surface Use: The visual resources in Retention VQO and those areas of Retention VQO and Low VAC are discussed as separate *Affected Environments*. Of the remaining VQO categories in the General Forest environment, only Partial Retention areas would require additional mitigation measures to maintain the adopted VQO. *Controlled Surface Use* would consist of only allowing drill pad development and use in Partial Retention VQO areas where vegetative or land form screening exist. This would minimize the visual impacts for the casual forest visitor along collector and arterial roads.

Timing Limitations: *Timing Limitations* would generally make no difference in terms of mitigation of impacts to visual resources in the General Forest environment. The primary factors involved in maintaining Visual Quality Objectives relate to the scale and amount of development, ground disturbance, and vegetation removal, large commercial vehicles, and the visual sensitivity of the recreational user. Limiting activity to a certain time period would not change the factors involved.

Standard Lease Terms: *Standard Lease Terms* would result in a major portion of Partial Retention VQO areas not meeting their adopted Visual Quality Objective. Some opportunity for mitigation of the potential adverse impacts to Partial Retention VQO areas exist, but only where adequate screening is present within the leasehold, and only when it does not infringe on the lessees rights as granted on the standard lease form (Appendix B). The estimated future visual condition would be approximately:

TABLE IV-1. VISUAL QUALITY OBJECTIVES UNDER STANDARD LEASE TERMS	
VQO	**PERCENT OF ANALYSIS AREA**
Preservation	0
Retention	3
Partial Retention	12
Modification	74
Maximum Modification	10

Environmental Factor: Recreation Opportunities

Developed Recreation

Note: Developed Recreation Complexes are discussed as a separate *Affected Environment.* See page IV-27 of this chapter.

No Lease: *No Lease* option would result in no net change to the developed recreation resource. However, there would be a slight potential for siting a drill pad or access road close enough to a developed recreation site that the recreational experience and setting at the site would be degraded.

No Surface Occupancy: *No Surface Occupancy* in this case would consist of requiring drill pad development and use to be located at least 1 mile from developed sites to lessen the noise and buffer the oil and gas activity from the developed site. It is possible that at the APD stage a specific timing stipulation (time of day for operation) would be determined to be needed.

Controlled Surface Use: *Controlled Surface Use* within a developed recreation site would result in little mitigation of the effects that would occur within the developed site. Developed recreation sites are designated for high density recreational use. Any oil and gas activity in a developed recreation site is in basic conflict with the intended use of the recreation site.

Timing Limitations: *Timing Limitations,* imposed to limit activity at a developed recreation site to the recreational off-use season, when developed sites such as campgrounds are closed, would lessen the impacts to the recreational user of those sites. Other developed sites such as those discussed under Recreational Complexes receive year-round use, and *Timing Limitations* would do little to mitigate the impacts of an industrial activity within a recreational site.

Standard Lease Terms: Under the *Standard Lease Terms* the developed site experience/recreation quality would potentially be significantly impacted from oil and gas activity. The result would be a potential decrease in use. However, the sensitive oil and gas operator would not likely propose operations in a developed recreation site. *Standard Lease Terms* allow reasonable mitigation; it would be reasonable to expect an operator to conduct activities outside a developed recreation site. However, there would be a potential for siting a drill pad or access road close enough to a developed recreation site that the recreational experience and setting at the site would be degraded.

Dispersed Recreation

Note: Dispersed Recreation Complexes are discussed as a separate *Affected Environment.* See page IV-27 of this chapter.

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* options would result in no net change to the dispersed recreation resource. However, there would be a potential for siting a drill pad or access road close enough to a dispersed recreation site that the recreational experience and setting at the site would be degraded.

Controlled Surface Use: *Controlled Surface Use* would locate development outside of special Dispersed Recreation Complexes and therefore limit major conflict with recreationists. Some reduction in quality of recreation experience and setting would still take place as development and operation of leases takes place adjacent to dispersed sites and to dispersed recreation in general.

Timing Limitations: The timing limitation in this case would consist of limiting drill pad development to low recreation use periods and therefore minimizing the conflict between industrial development and recreation use. *Timing Limitations* would still result in a reduction in the dispersed recreation experience/recreation quality and setting for most recreationists.

Standard Lease Terms: Under the *Standard Lease Terms* some quality degradation of recreation experience and setting would take place. This would generally not be significant except in those special Dispersed Recreation Complexes as discussed as a separate *Affected Environment.*

Recreation Opportunity Spectrum (ROS)

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* options would result in no net change to the recreation opportunity spectrum.

Controlled Surface Use: The *Controlled Surface Use* stipulation would consist of protecting inventoried General Forest Semi-primitive Motorized areas by limiting drill pad development and roads to existing travel routes. (Semi-primitive Non-motorized areas are discussed as a separate *Affected Environment.*) Some reduction in quality of recreation experience and setting would still take place as exploration, development, and operation occurs.

Timing Limitations: *Timing Limitations* would make no difference in terms of mitigation of consequences, as the primary factors of impact are related to the presence of drill pads and roads (setting), versus dispersed SPM (backcountry) recreational experience. The presence of oil and gas activity would detract from the natural appearing setting.

Standard Lease Terms: *Standard Lease Terms* would result in a change in the inventoried Recreation Opportunity Spectrum. Based on the proposed activities in the RFD, access and intrusion of motorized use, the standard of developments (roads, in particular) and the distance from access would alter the existing ROS classes in the analysis area. The estimated future ROS inventory would be approximately:

TABLE IV-2. ROS CLASS COMPOSITION UNDER STANDARD LEASE TERMS	
ROS CLASS	**PERCENT (%) OF ANALYSIS AREA**
Urban (U)	0
Rural (R)	1
Roaded Natural (RN)	25
Roaded Modified (RM) [subclass of RN]	14
Semi-primitive Motorized (SPM)	44
Semi-primitive Non-motorized (SPNM)	16
Primitive (P)	0

Wild and Scenic Rivers

None of the lease options would result in a change to the *Affected Environment*. No wild and scenic rivers have been identified in the analysis area.

Wilderness

None of the lease options would result in a change to the *Affected Environment*. No Wilderness areas, Wilderness Study Areas or Further Planning Area for Wilderness exist in the analysis area.

Environmental Factor: Cultural and Historical Resources

All options would consist of avoidance of significant prehistoric and historic archaeological resources (the five proposed archaeological districts). None of the lease options would result in a change to the *Affected Environment*. Under all lease options, at the APD stage a cultural survey is required to be performed on all areas proposed for ground disturbing activities before such activities commence (for further discussion see Cultural and Historical Resources in Chapter III). If a cultural resource is identified by the survey, it would be protected by avoidance or excavation and recordation. Furthermore, the standard stipulations require the lessee to report and protect all cultural resources found during construction. These requirements are for compliance with 36 CFR 800, EO 11593, and the National Historic Preservation Act of 1966, as amended.

Environmental Factor: Wildlife

Big Game

The five lease options are discussed as they relate to the following big game species in the General Forest environment: mule deer, elk, desert bighorn, Rocky Mountain bighorn, mountain goat, antelope, black bear, mountain lion, and wild turkey. (Habitats i.e. Big Game Winter Range, elk calving areas, Migration Routes and Stating Areas, Summer Concentration Areas, Bighorn Sheep Lambing and

Breeding Areas are discussed later in this Chapter.) Specific mitigation measures to minimize adverse effects on these species and their habitat, will be identified when an Application for Permit to Drill (APD) has been filed for a specific area.

No Lease: *No Lease* would provide complete protection of the big game resources. *No Lease* would result in no adverse impacts to big game.

No Surface Occupancy: Big game and their habitat under the *No Surface Occupancy* would not be as adversely affected as those areas under the other lease options. Line of sight noise from exploration or development on adjacent land could displace big game for several miles or at least one or two drainages away from their traditional use areas. This disturbance factor would have the greatest effect on those species with the smallest home ranges such as the wild turkey, mule deer, desert bighorn sheep and the Rocky Mountain Bighorn Sheep. The pronghorn antelope and the elk could experience this disturbance to a greater degree. The black bear and mountain lion would be the least affected because they have the largest home ranges and the greatest flexibility to move away from any disturbance. The greatest effect on these two species could come from movement of their prey, which would then affect the lion or bear.

Controlled Surface Use: *Controlled Surface Use* would be applied where necessary to protect wildlife resources from potential adverse impacts from well location or new road construction. *Controlled Surface Use* would be used to physically protect critical big game habitat such as wild turkey roosting sites, bighorn sheep nursery, and bedding sites, antelope fawning sites, known black bear and mountain lion denning sites, mineral licks, critical watering or feeding sites, elk wallows, etc. (Also, see discussions on additional critical habitats discussed separately.) Development would be located where terrain or vegetation would serve as buffers between oil and gas activities and the habitats to be protected. These mitigation measures would lessen the effects on big game.

Timing Limitations: *Timing Limitations* would lessen the potential for adverse impacts to big game species. The following is a list of *Timing Limitations* designed to protect big game and their "critical habitats" (not discussed elsewhere) during certain critical time periods of their life cycle:

Pronghorn Antelope Fawning Areas	May 1 to July 15
Mule Deer Fawning Areas	May 1 to July 15
Mountain Goat Kidding Areas	May 1 to July 15
Desert Bighorn Sheep Lambing Areas	March 15 to June 1
Black Bear Spring Range	March 15 to July 1
Wild Turkey Nesting Areas	April 1 to May 30

Standard Lease Terms: *Standard Lease Terms* are the least restrictive of all the lease options. Disturbance to big game and degradation of habitat could occur to any of the big game species found in the area. The effects of oil and gas activities on big game and their habitat varies considerably, depending on the stage of the activity being performed. Impacts from the drilling of exploratory wells would be greatly increased on big game and their habitats, because of the much longer period of disturbance. Continued displacement from preferred habitat and traditional home ranges forces the animals to move into more marginal habitats or onto already occupied optimum habitat, resulting in overcrowding and over utilization of the range and greatly increasing the threat of disease transmittal. The direct loss of habitat due to road construction and drill pad layout is also a consideration. However, this direct loss of habitat can be somewhat mitigated by trying to locate these sites away from critical or preferred habitat. The actual loss of habitat from road construction is not as important as the effects of increased traffic and human activity associated with the road itself.

Standard Lease Terms would not mitigate all of the most detrimental impacts to crucial wildlife habitat from oil and gas development. Detrimental impacts that could occur under the *Standard Lease Terms* include: (1) disturbance to big game birthing habitat and crucial winter range habitat; (2) new

road construction into unroaded or isolated areas; (3) impacts to Aquatic, Riparian, and Wetland habitats.

Upland Game, Small Game, Furbearers, Non-game Wildlife

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would provide complete protection from the impacts of oil and gas activities for small gamebirds and mammals, waterfowl, shorebirds, raptors, and non-game wildlife and their critical habitats, in the analysis area.

Controlled Surface Use: *Controlled Surface Use* would be used here if it is felt that additional roading into an area would cause direct population loss to a species or group of wildlife species. If additional roads were built into an area it would have to be assumed that other cause and effect connected actions such as timber sales would be initiated and this action would potentially have more effect on these species than would the actual oil and gas development.

Timing Limitations: *Timing Limitations* would lessen the potential for adverse impacts to upland game birds, small game, waterfowl, raptors, shorebirds, passerines (song birds), and raptors. Human activity associated with oil and gas exploration or development should be restricted one month prior to nest selection to one month after hatching for large raptor species. The following is a list of *Timing Limitations* designed to protect these species and their "critical habitats" during certain critical time periods of their life cycle:

Golden Eagle	March 1 to August 15
Ferruginous Hawk	February 1 to August 15
Osprey	April 1 to August 15
Prairie Falcon	February 1 to August 15
Canada Geese	March 1 to May 30
Greater Sandhill Crane	March 1 to October 16

Standard Lease Terms: Impacts to these species from oil and gas exploration and development activities could result in nest or den abandonment, actual destruction of nesting and denning sites and habitat, and the elimination of one or more of a species key habitat components necessary for the survival of the species. Key habitat components requiring protection include: roosting sites, nesting grounds, breeding areas, important feeding sites, prey species habitats, and old growth forests. Drilling operations during a species courtship display periods, nest or den construction periods, egg laying/incubation or young bearing time periods could cause a species to abandon any further attempts to produce young. Some birds exhibit behavioral responses which are greatly influenced by humans and human related activity. For example the response of large raptors to human activity may vary considerably from species to species and from individual to individual. For many species, like the golden eagle, nest abandonment is most likely to occur prior to or during the egg laying process rather than after young have been hatched and are being fed routinely. Disturbance to birds and mammals at their nesting or denning sites can cause excessive cooling of eggs or chilling of young birds and mammals, because parent birds and mammals remain away from the young, due to the presence of people. Premature fledging or movement away from nesting and denning sites can cause death to birds falling from nests or can result in the young being preyed upon by other birds or mammals. Raptors such as eagles, hawks, falcons, and owls are especially sensitive to human related activity or disturbance. Impacts to the young of many mammal species may not be as common because mammals tend to hide nests out of sight of man, or underground. While the nests of birds, especially cliff dwelling and tree nesting species are often very visible. The impacts to many amphibians and reptiles is largely unknown at this time, because many of these species make small dens underground, which may be afforded better protection. The assessment of impacts on small forest birds and mammals, waterfowl and shorebirds are less know. Small forest birds and mammals have relatively small home ranges and would not be adversely affected unless roads or drill pad construction areas were constructed directly on or adjacent to their individual home ranges.

This leasing option would provide little protection to a large variety of both game/non-game mammals and birds. Key habitat components, such as cliffs, caves, rock outcrops, areas adjacent to Wetlands, wintering zones, and other habitats would remain unprotected.

Management Indicator Species

The effects of oil and gas exploration and development activities on the Management Indicator Species (MIS) would vary considerably depending on which species is being addressed. The effects anticipated can be related to the size of the home range of the species, whether the species is migratory or non-migratory, or if the species has a very narrow habitat type dependency. The five lease options are discussed as they relate to the management indicator species:

No Lease: *No Lease* would maintain all habitat components for those species with smaller home ranges and would protect at least a portion of those habitat components of the species with large home ranges or that are migratory in nature. *No Lease*, if used for any MIS or its habitat, would protect areas of critical importance to a species or a group of species.

No Surface Occupancy: *No Surface Occupancy* would protect any habitat component felt to be critical to the survival of a localized population of animals.

Controlled Surface Use: *Controlled Surface Use* would protect the habitat of species like the pine marten, goshawk, or Abert's squirrel. These three species would lose the most by allowing new roads in previously unroaded habitat. Restrictions in mature ponderosa pine habitats would lessen impacts to Abert's Squirrels. Avoiding known goshawk nesting sites when selecting road and drill pad locations would reduce impacts to these raptors. Controlling access into conifer stands lessens the potential for increasing trapping pressure on pine martins and other furbearers they represent.

Timing Limitations: *Timing Limitations* would lessen the potential for adverse impacts to Management Indicator Species and/or the species and habitat they represent. The following is a list of *Timing Limitations* designed to protect these species and their "critical habitats" during certain critical time periods of their life cycle:

Sage Grouse Wintering Areas	December 16 to March 15
Goshawk Nest Site	March 15 to July 31
Pine Marten Den/Young Rearing Sites	April 1 to June 30
Abert's Squirrel Nest Sites	April 1 to June 30

Timing Limitations alone, would not prevent habitat loss due to oil and gas activities being conducted outside these time periods.

Standard Lease Terms: *Standard Lease Terms* would provide little or no protection to any of the Management Indicator Species or their key habitat components. Oil and gas activity would result in an increased potential for adverse impacts to MIS and/or the species and habitat they represent.

Oil and gas activity in itself, would have less of an effect on the pine marten than the connected action of potential timber harvests in previously unroaded areas. Timber harvest would fragment old growth stands, making habitat much less capable of supporting healthy pine marten populations. Timber harvest would also destroy habitat for the red-backed vole, one of the chief prey species for the pine marten. New roads would allow increased trapper access. Habitat loss and direct mortality due to trapping could potentially deplete or exterminate pine marten populations.

Disturbance from any human related activity could cause goshawk to abandon nests, especially in the early stages of egg laying and incubation.

The Abert's squirrel has a very narrow range of habitat use, requiring mature ponderosa pine forests exclusively, for its livelihood. Individuals have very small home ranges and would be adversely affected by new road construction or drill pad construction in mature or old growth stands of ponderosa pine. This would result in a loss of already very limited habitat. Roads through prime habitat would result in direct mortality of animals crossing these roads.

Red crossbill individuals could be adversely affected by oil and gas road construction or drill pad development, but this species and similar species would be more adversely affected by timber harvesting connected actions.

The Hairy and Lewis' woodpeckers would be only slightly impacted by road or pad construction.

Environmental Factor: Wildfire

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional threat of wildfire as a result of increased human activity in an area. However, access that may have been provided to an area with oil and gas activities would not be available to assist in the control of wildfire.

Controlled Surface Use and Standard Lease Terms: Oil and gas activities would result in an increased potential for wildfire occurrence as a result of human activities in an area. Access provided by the activities would result in improved access to previously inaccessible areas and would aid in the suppression of wildfire. Operators would be required to have and maintain in good operating condition, fire control equipment commensurate with the size of their operations.

Timing Limitations: *Timing Limitations* restricting activity during periods of high fire hazard would lessen the potential for impacts related to oil and gas activity

Environmental Factor: Economics - Cost to Industry

No Lease: *No Lease* would result in an area not being available for oil and gas leasing and the subsequent activity related to the search for oil and gas resources. Opportunities for capital gains as a result of discovering oil and gas resources would be lost from the areas of *No Lease*.

No Surface Occupancy: *No Surface Occupancy* stipulated on a certain piece of ground, would require the operator to access the oil and gas resources from outside the area. Directional drilling techniques would have to be employed to recover oil and gas resources beneath an area stipulated as *No Surface Occupancy*. These directional drilling techniques are much more expensive, in terms of the equipment and number of personnel involved in the activity. The risk for missing the target formation would also be higher. The costs and the risk involved in directional drilling may preclude exploration for oil and gas resources in the area. *No Surface Occupancy* has an adverse affect on the oil and gas industry.

Controlled Surface Use: The mitigation measures specified for the various *Affected Environments* discussed in this Chapter and in Appendix H, would result in higher exploration, road, well pad, and pipeline construction, and operating costs to the operator, than would *Standard Lease Terms*. In some cases, the costs may be so high that the operator may not choose to drill until oil and/or gas prices would be high enough to justify the additional costs.

Timing Limitations: *Timing Limitations* on an operator compresses the time available for exploration and development activities to occur on a leasehold. This may result in a need for a larger workforce to accomplish the work and any required reclamation prior to late fall and winter. In many areas of the Forest, because of the harsh climatic conditions found at the higher elevations, operators typically cannot work from the first of February through May because of snow and poor road conditions. *Timing Limitations* outside that window would likely increase costs to the operator.

Standard Lease Terms: *Standard Lease Terms* would be the least impacting to the oil and gas industry in terms of operating costs. Reasonable mitigation measures, as provided by *Standard Lease Terms*, would be an additional financial burden on industry, as compared with operating costs on non-federal lands.

NOTE: The next section describes the environmental consequences of lease options in those unique Affected Environments identified in Chapter III. For an understanding of the overall organization of this chapter, refer to the description of the analysis process in Chapter I. Only those environmental factors which are uniquely affected in a given *Affected Environment*, are discussed under each of the following *Affected Environment* discussions. Affects, in terms of other environmental factors are covered in the discussions of environmental consequences in the General Forest.

Floodplains

Habitats in Floodplains are also generally discussed below under Aquatic/Riparian/Wetland Habitats. Regardless of the lease option, oil and gas activity within Floodplains are subject to approval in a Surface Use Plan of Operations. The majority of the impacts would occur from road construction and location. Timing of activities and mitigation efforts may also influence how significant or severe these impacts may be.

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would effectively eliminate surface water quality impacts in the Floodplain environment.

Controlled Surface Use: *Controlled Surface Use* in the Floodplain environment would not allow the placement of well pads, tank batteries, pipelines or gravel sources within the Floodplain. Location of facilities and the potential pollutants outside the Floodplain would result in a decreased potential and risk for water quality impacts.

Timing Limitations: During the wet times of the year the ground is saturated or flooded, which would result in increased soil disturbance and potential for transport of pollutants to the nearby stream. Restricting or eliminating use in the Floodplain during those wet seasons would prevent unnecessary water quality degradation.

Standard Lease Terms: *Standard Lease Terms* could allow the operator to site facilities within the Floodplain, subject to reasonable mitigation measures. Within the realm of reasonable mitigation measures, the Forest authorized officer, with sufficient reasons, could require the operator to site facilities outside the Floodplain. Road, well pad, and pipeline construction, removal of vegetation, drilling activities, and the storage of potentially toxic materials within a Floodplain would potentially result in water quality degradation. The Floodplain is an extension of the stream itself and its contamination or alteration would have a direct impact upon the water quality and hydrologic function of the stream.

Aquatic / Riparian / Wetland Habitats

For the purposes of this discussion, "Riparian areas" include the Aquatic ecosystem (includes fisheries habitat), Riparian ecosystem and Wetlands. Regardless of the lease option, oil and gas activity within Riparian areas and Wetlands are subject to approval in a Surface Use Plan of Operations. The majority of the impacts would occur from road construction and location, culvert placement and stream crossings. Timing of activities and mitigation efforts may also influence how significant or severe these impacts may be.

Further discussion of the importance and function of these *Affected Environments* (Aquatic, Riparian and Wetlands) is included in the discussion of the effects of the program alternatives on pages IV-64 to IV-67 of this chapter.

Environmental Factor: Vegetation

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect to vegetation in Aquatic habitats, Riparian areas, and Wetlands within the analysis area, except where road or pipeline crossings are approved in a SUPO.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: *Controlled Surface Use, Timing Limitations,* and *Standard Lease Terms* could allow vegetation removal within this environment. This would lead to an increased potential for water quality impacts as some of the natural sediment filtering mechanism that vegetation provides would be removed.

Environmental Factor: Soils

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no increase in impacts except where road and pipeline crossing through these areas are approved in a SUPO. Mitigation measures would be applied to lessen these impacts.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: Because of the sensitivity of these areas, *Controlled Surface Use, Timing Limitations* and *Standard Lease Terms* would result in relatively major disturbance and would have a high potential for causing substantial impairment of soil productivity, releasing large amounts of sediment into active waterways, lakes or ponds. These soils, due to generally high water tables and large amounts of organic matter, are very sensitive and susceptible to rutting, displacement, puddling and erosion. Large scale disturbances resulting in rutting, displacement, puddling, or erosion would be potentially detrimental to long-term productivity and the integrity of the entire ecosystem.

Environmental Factor: Water Quality and Quantity

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* within Aquatic habitat, Riparian areas, and Wetlands would result in no additional effects to existing water quality. On occasion Riparian crossings by roads or pipelines would be unavoidable. Recognizing that these exceptions would occur there would be potential for impacts to water quality. Sediment would be the most significant potential water quality effect. Disturbance adjacent to and within the channel and road fill placement during construction, make crossings typically high, short-term sediment producers. Long-term impacts also occur from sediment transported down the road bed, ditches, and fill slopes and deposited directly into the stream.

Other water quality risks associated with stream crossings pertain to the traffic on the road and the material transported. There is always potential for an accident that would spill chemicals such as fuel, drilling mud agents, condensate and waste water into the stream. Many of these are considered hazardous and toxic materials. An operator is required to have a Spill Prevention Control and Countermeasure Plan in place prior to any activities, which is designed to minimize potential impacts.

Protection of Riparian areas and Wetlands would also help to reduce water quality impacts, which could occur from activities on the General Forest. Riparian areas are important buffers and filters which prevent pollutants from entering stream courses and bodies of water.

Standard Lease Terms: Riparian areas and Wetlands are identified as areas of *No Surface Occupancy* under Forest Service oil and gas regulations. Because of the close proximity to surface water sources and shallow groundwater tables, water quality is easily degraded within this environment. Loss

or decline in condition of Riparian and Wetland areas would also reduce their effectiveness in improving the water quality contributed by upstream areas. Water quality impacts would occur directly as a result of the activities associated with exploration, development and production of oil and gas. Long term impacts could also occur indirectly, through the loss of Riparian/Wetland function.

Environmental Factor: Fisheries and Aquatic Habitat

No Lease: *No Lease* would result in no additional adverse impacts on the Aquatic habitat and the fisheries and aquatic organisms associated with it. *No Lease* would allow for maintenance of the existing conditions, and would provide for Aquatic and Riparian protection.

No Surface Occupancy: *No Surface Occupancy* would generally provide for protection of the fisheries and Aquatic system, by disallowing any activities within the Riparian area (stream ecosystem and Riparian ecosystem). However, the potential for impacts from activities which occur outside the Aquatic/Riparian corridor is high. Also, this option may not preclude the need for roads through stream and Riparian systems and thus, the impacts associated with road construction would be unavoidable and would be mitigated. This potential exists with all the lease options, and does not necessarily mean that because there is *No Surface Occupancy* or *No Lease*, there would be no possibility of impacting the resources these options are designed to protect.

Standard Lease Terms: *Standard Lease Terms* have the greatest potential for impacting the Aquatic and Riparian ecosystems than any of the other lease options. The potential for significant long-term impacts is increased considerably, because this lease option is dependent on the agency's ability to administer and monitor the oil and gas leasing activities and enforce the regulations associated with this option. Because of the inherent sensitivity of these Aquatic and Riparian ecosystem and their interdependence upon each other for maintaining habitat quality, the potential for irreversible impacts from this lease option are high. Depending on the "current conditions" of the Aquatic and Riparian habitats, this lease option may not provide enough protection from activities adjacent to the Aquatic/Riparian corridor, and from existing leases.

Environmental Factor: Riparian (Wetlands)

No Lease: *No Lease* would provide for the protection of the Aquatic as well as the Riparian resources. The major functional attributes referred to on page IV-13, would be preserved and the over-all health of the Riparian area would be maintained. Consideration must be given, however, to activities which are allowed in areas adjacent to these Riparian areas that may result in impacts to the Aquatic and Riparian resources downstream or adjacent to the oil and gas operation sites. Activities such as road construction, culvert placement and stream crossings would still be permitted under the *No Lease* option, and these activities may have direct impacts on the Aquatic and Riparian resources. This is especially critical when dealing with areas where the Riparian area is in a less than desirable condition as a result of past activities, and is not able to function effectively in the manner referred to previously. If this is the case, then there is an increased possibility that the Aquatic resource will be impacted.

No Surface Occupancy: This lease option may help to preserve the integrity of the Aquatic/Riparian system, but would not provide adequate protection where the oil and gas activities are closely associated with the Riparian areas. There is still the potential for "off site" impacts from sediment flow, mass wasting and spill of hazardous materials, that have to be considered.

Standard Lease Terms: Again, as under the "Fisheries and Aquatic Habitat" section, this lease option is the least restrictive of the five and has the potential to have the greatest impact(s) on the Riparian area (Aquatic and Riparian ecosystems). Even with specific stipulations and mitigation, this lease option may have the potential to cause irreversible damage to the Aquatic and Riparian habitats. The other options are designed to prevent loss or damage to the Riparian and stream systems, where this particular option is dependent on proper mitigation techniques and the agency's ability to closely

monitor the activities taking place. Too often, the impacts are at a level where mitigation is not effective and the subsequent impacts to the resources are long-term and significant.

Alpine / Tundra Areas

Environmental Factor: Vegetation

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no net change to the *Affected Environment*. No disturbance of Alpine/Tundra vegetation would occur.

Controlled Surface Use: *Controlled Surface Use* would partially mitigate some of the impacts to vegetation. Revegetation techniques in alpine areas have not been totally proven effective, but practices that have shown limited success are: lifting and saving the tundra vegetation in chunks of sod to be later placed over the disturbed areas usually works for short time periods of disturbance (up to two months), intense collection of local seeds for later revegetation and purchasing of special high-elevation seed (not readily available), the use of chemical stabilizers, tackifiers and blankets. All of this, with very close control of water flow over the site and continual monitoring of effectiveness would help to mitigate impacts to vegetation.

Most attempts at mitigation and rehabilitation would result in an environment modified from natural conditions.

Timing Limitations: *Timing Limitations* during those times of the year when the alpine ecosystem is most susceptible to damage, would mitigate some of the effects to vegetation in these areas. Winter drilling or drilling on snow and avoidance of activities during saturated soil conditions, would be required to lessen the effects of activities on soils and thus, vegetation in Alpine/Tundra areas. However, some vegetation removal and disturbance would still occur.

Standard Lease Terms: The use of *Standard Lease Terms* would result in long-term environmental consequences. The overall harsh conditions, high potential for water and wind erosion, and extremely low revegetation potential, would result in a disturbance that would irreversibly alter the Alpine/Tundra ecosystem.

Environmental Factor: Soils

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no net change to Alpine/Tundra areas. They would protect the resource values of alpine areas. No accelerated erosion would occur, and ecosystems would remain intact. The natural soil environment would remain undisturbed. These are the only lease options that would leave alpine ecosystems in an unaltered condition.

Controlled Surface Use: *Controlled Surface Use* would partially mitigate some of the impacts on the soil resource. Due to the harsh conditions and high moisture conditions at times, very intense state of the art erosion control measures would be required, (i.e., geotextiles, erosion control fabric, mats, geoweb soil support materials, etc.) to maintain erosion at acceptable limits.

Most attempts at mitigation and rehabilitation would result in an environment modified from natural conditions.

Timing Limitations: *Timing Limitations* during those times of the year when the alpine ecosystem is most susceptible to damage would mitigate some of the effects to the soil resources in these areas. Winter only drilling or drilling on snow only and avoidance of activities during saturated soil conditions would be required to lessen the effects of activities in Alpine/Tundra areas.

Standard Lease Terms: Without mitigation, the use of *Standard Lease Terms* would result in long-term environmental consequences. The overall harsh conditions, high potential for water and wind erosion, and extremely low revegetation potential, would result in a disturbance that would irreversibly alter the alpine ecosystem.

Environmental Factor: Water Quality

These areas generally receive abundant precipitation. Due to harsh climate and shallow soils, Alpine/Tundra areas are very susceptible to damage, and slow to recover. Water quality is easily impacted within these fragile ecosystems. Sediment and acid rock drainage are water quality parameters which are most at risk of being adversely impacted within this environment.

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no environmental consequence to water quality.

Controlled Surface Use: *Controlled Surface Use* stipulations would include measures to minimize and eliminate surface disturbance. In addition containment and disposal of both surface and groundwater would be important in protecting water quality. The shallow soils would provide poor absorption and buffering capacity in the event of spills. Extraordinary measures such as those discussed above in "Environmental Factor: Soils" would be necessary in order to achieve adequate reclamation to protect water quality.

Timing Limitations: *Timing Limitations* during those times of the year when the alpine ecosystem is most susceptible to damage would mitigate some of the effects to water quality in these areas. Winter drilling or drilling on snow and avoidance of activities during saturated soil conditions would be required to lessen the effects of activities on soils, and thus, water quality in Alpine/Tundra areas. However, some vegetation removal and disturbance would still occur.

Standard Lease Terms: Under the *Standard Lease Terms* water quality effects may be both significant and long term. Typical operations and mitigation would not be very effective at preventing adverse impacts to water quality in Alpine/Tundra areas.

Environmental Factor: Visual Resources

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect on the visual resources in Alpine/Tundra areas.

Controlled Surface Use: The impacts of oil and gas activities on the visual resources in Alpine/Tundra areas would be lessened by the use of the mitigation measures specified for the soil and vegetation resources. However, some long-term affect on the visual resources in these areas would be expected, due to the harsh climatic conditions, the short growing season, the lack of screening vegetation, and shallow soils. In other words, soil disturbance and vegetation removal from oil and gas activity in these areas would be slow to heal and hard to hide.

Timing Limitations: *Timing Limitations* during those times of the year when the alpine ecosystem is most susceptible to damage would mitigate some of the effects to visual resources in these areas. Winter drilling or drilling on snow and avoidance of activities during saturated soil conditions would be required to lessen the effects of activities on soils and vegetation in Alpine/Tundra areas. However, soil disturbance and vegetative impacts would likely occur as a result of road and drill pad construction, and impact visual resources.

Standard Lease Terms: Impacts to visual resources in Alpine/Tundra areas would likely be long-term due to the harsh climatic conditions, the short growing season, lack of screening vegetation, and shallow soils. Scars from oil and gas activities in these areas would be highly visible and would detract from the natural setting.

Environmental Factor: Recreational Use and Opportunities

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would allow existing recreational use and opportunities to continue in Alpine/Tundra areas without disturbance from oil and gas activity.

Controlled Surface Use: The potential impacts to recreational uses and opportunities may be somewhat lessened by the use of mitigation measures that strictly control noise and visual impacts. Generally, industrial activity in this environment would degrade the recreational experience and would likely result in decreased use by recreationists.

Timing Limitations: The season of use for both activities, oil and gas and recreation, is very short due to adverse weather conditions. A *Timing Limitation* on the oil and gas industry that covers the recreational use period could effectively eliminate the potential oil and gas activity. The length of time on either end of the *Timing Limitation* would probably be too short for oil and gas operations to occur. The oil and gas operations would be up against adverse weather, which could jeopardize both their operations and the environment.

Standard Lease Terms: The potential impacts to recreational uses and opportunities may be somewhat lessened by the use of mitigation measures that strictly control noise and visual impacts. Generally, industrial activity in this environment would degrade the recreational experience and would likely result in decreased use by recreationists. *Standard Lease Terms* may be somewhat less effective than *Controlled Surface Use* in providing the mitigation and the strict control that would be required in this sensitive environment.

Areas of High Geologic Hazard

Environmental Factor: Geology

Forest Service regulations at 36 CFR 228.108(j) do not allow an operator to conduct operations in areas subject to mass soil movement except as approved in a Surface Use Plan of Operations.

No Lease: *No Lease* in High Geologic Hazard areas would result in no increased impacts over natural baseline levels of mass soil movement.

No Surface Occupancy: *No Surface Occupancy* would result in a slightly increased potential for impacts over natural levels. If approved in a SUPO, an operator could occupy the surface of an area subject to mass soil movement. The potential for effects as a result of operations in an area subject to mass soil movement would be greater than if the area was not leased (even assuming the operator would have to propose acceptable mitigation and design measures in areas subject to mass soil movement in order to have his SUPO approved).

No Surface Occupancy attached to the lease would put the requirement of *No Surface Occupancy* up front with the lease. The Forest Service administrator of the lease would not have to rely solely on the regulations to adequately protect the resources (water quality and soil productivity) that could potentially be adversely affected by the acceleration of slope movements such as landslides, mudflows, and earthflows. The area would be identified in the stipulation, whereas if not stipulated, the operator may not be aware that there is an area on the leasehold that he cannot occupy.

Timing Limitations: *Timing Limitations* would do little to reduce the potential for mass soil movement. Ground-disturbing activity in an area subject to mass soil movement greatly increases the potential for acceleration of slope failure, regardless of when it occurs.

Standard Lease Terms: *Standard Lease Terms* would result in a slightly increased potential for acceleration of slope movement over background levels. With this option a stipulation specifically addressing High Geologic Hazards would not be attached to the lease. Although areas subject to mass soil movement are protected by Forest Service regulation, the potential for adverse impacts is slightly higher due to lack of prior identification and acknowledgment of High Geologic Hazard in the area, i.e., the Forest Service administrator and the lessee may not be aware of the geologic hazard. Even with mitigation measures as specified in a SUPO, the potential for adverse impacts to soil and water resources would be greater than if the site was not occupied.

Environmental Factor: Water Quality

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effects to water quality. Activities outside a leasehold could result in acceleration of slope movement, especially if the hydrologic influence zone of the landslide extends outside the leasehold. Activity within the hydrologic influence zone could contribute to acceleration of slope movement. Also, vibration within a rock strata underlying an unstable area could initiate movement.

Controlled Surface Use: *Controlled Surface Use,* such as no new road construction or well pads, would eliminate much of the potential for impacts to water quality. The location of well pads in unstable areas would likely impact water quality due to undercutting or overloading slopes, and thus increase the probability of a failure occurring. Shifts and movement within the regolith could result in damage to the drill pipe and casing, which would then threaten contamination of groundwater.

Timing Limitations: *Timing Limitations* would do little to reduce the potential for mass soil movement. Ground disturbing activity in an area subject to mass soil movement greatly increases the potential for acceleration of slope failure and water quality degradation, regardless of when it occurs.

Standard Lease Terms: *Standard Lease Terms* would result in an increase in sediment delivered to nearby drainages. These are areas with high natural erosion rates that are easily accelerated by surface disturbing activities. Areas prone to mass movement are characterized by dissected topography with high drainage densities. This increases the likelihood of sediment reaching streams.

Areas of Moderate Geologic Hazard

Environmental Factor: Geology

No Lease: *No Lease* in Moderate Geologic Hazard areas would result in no increased impacts over natural baseline levels of mass soil movement.

No Surface Occupancy: *No Surface Occupancy* would result in a potential increase over baseline slope movement levels. The potential for effects would be similar to that described below for *Controlled Surface Use.* This assumes the operator would have to propose adequate mitigation and design measures to have a waiver, exception, or modification to the *No Surface Occupancy* stipulation approved.

Controlled Surface Use: With special road and well pad design by qualified engineers or engineering geologists, the potential for adverse impacts in areas of Moderate Geologic Hazard would be lessened, compared to *Standard Lease Terms.* The design must consider drainage, backslope and fillslope ratios, and road grade and standards relative to the engineering properties of the materials at the site. Even with design appropriate for the soil conditions, ground disturbing activities in Moderate Geologic Hazard areas increases the potential for activation of landslides, earthflows, and mudflows over that of a natural, undisturbed site.

Timing Limitations: *Timing Limitations* would do little to reduce the potential for mass soil movement. Ground disturbing activity in an area subject to mass soil movement greatly increases the potential for failure regardless of when it occurs.

Standard Lease Terms: The use of *Standard Lease Terms* in areas of Moderate Geologic Hazards fails to recognize the potential for adverse impacts to surface resources. Without consideration of the potential for slope failure, slope failure would likely occur. The majority of the slope failures would probably be small, affecting only the cut and fill slopes of newly constructed roads or well pads. However, the potential for triggering a massive slope failure would be greatly increased, especially in those areas of active and past active slopes.

Environmental Factor: Water Quality

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* of areas with Moderate Geologic Hazards would result in no additional effects to water quality.

Controlled Surface Use: The use of a *Controlled Surface Use* stipulation would eliminate much of the impacts to water quality. The location of well pads in unstable areas would likely impact water quality due to undercutting or overloading slopes, and thus increase the probability of a failure occurring. Shifts and movement within the regolith could result in damage to the drill pipe and casing which would then threaten contamination of groundwater.

Timing Limitations: *Timing Limitations* would do little to reduce the potential for water quality contamination, which is high in this environment.

Standard Lease Terms: *Standard Lease Terms* would result in an increase in sediment delivered to nearby drainages. These are areas with high natural erosion rates that are easily accelerated by surface disturbing activities. Areas prone to mass movement are characterized by dissected topography with high drainage densities. This increases the likelihood of eroded materials reaching stream courses as sediment.

Roadless Areas

Environmental Factor: Recreation/Visual Resources/Wilderness Values

Opportunities for Semi-primitive to Primitive recreation experiences are currently being provided by the Roadless Areas in the analysis area. These experiences vary according to the specific area (refer to specific descriptions in Chapter III). Effects are a function of whether exploration and development are allowed or not, rather than of which leasing stipulation is imposed. The lease option stipulations have limited true mitigating effects on the character of the area. Essentially any development would significantly effect the nature of the recreation experience, reducing what is now a Semi-primitive or Primitive environment (see ROS Users Guide for definitions of these environments), to a Roaded Natural one, in that portion of the affected Roadless Area. Even areas with closed roads, once roads and drill pads are in place, do not meet the appearance and experience criteria to be called Semi-primitive or Primitive. Operations and maintenance traffic would further detract from the solitude/remoteness/naturalness associated with the Semi-primitive and Primitive ROS classes.

Another consequence of the development of Roadless Areas for oil and gas is the impact on opportunities for high quality, guided hunting and camping experiences. Outfitter/guides focus the majority of their activities in remote and inaccessible areas. Each of the Roadless Areas in the analysis area has some of this type of activity permitted in it. Reduction in the unroaded character or remoteness of these areas would significantly reduce the quality of the experience for people now willing to pay substantial fees for camping and hunting with an outfitter/guide, in a "backcountry" environment. Oil and gas activities could significantly degrade the attractiveness of the overall experience that a

particular outfitter/guide offers, and result in significant loss of financial opportunities for him. It would also reduce the overall amount of this type of experience available in the area.

Specific descriptions in Chapter III of each of the Roadless Areas in the analysis area, allow for the consideration of the character of each Roadless Area, and the true nature of wilderness opportunities lost in the event of a choice to develop oil and gas resources in them.

Where stipulations are attached to a lease to protect roadless values in Roadless Areas (such as *NSO* applied to the Battlement Mesa Roadless Area) waivers, exceptions and modifications will be considered only if the proposed activity would protect the roadless value and character of the area. Under this EIS, *NSO* is the only stipulation used to protect the roadless character of a Roadless Area.

No Lease: With *No Lease* in this *Affect Environment*, Roadless Areas would not be available for oil and gas leasing. No impacts from oil and gas activity would occur to Roadless Areas not available for leasing (except for potential activity in those areas already leased). No roads would be allowed in Roadless Areas not available for leasing.

No Surface Occupancy: Roadless Areas with *NSO* would be available for leasing, but surface occupancy would not be allowed. However, surface resources may be impacted if a waiver, exception, or modification of this stipulation were granted. A waiver, exception or modification of this stipulation allowing road construction would result in some loss of roadless values.

Controlled Surface Use and Standard Lease Terms: Development associated with oil and gas exploration results in direct loss of roadless character. The result is a lost opportunity for that area to be added to the National Wilderness System in a roadless and undeveloped state.

Under any of the three lease options allowing development and surface occupancy, oil and gas development in these areas could amount to no more than a single access road and drill pad, resulting in a dry hole which is plugged and abandoned. The road would then be obliterated. However, in the event of a successful find, coupled with increasing prices for natural gas, full field development could result in a "Most Development Possible" scenario. The amount of roads, drill pads and pipelines under this scenario would certainly change the character of the Roadless Area and would eventually reach that described in the "Description of Typical Oil and Gas Activities - A Layman's Experience" in Appendix G.

The selection of either of these lease options for Roadless Areas would result in surface use within the leasehold. Roads, well pads, buildings, and possibly pipelines would be allowed. Under *Controlled Surface Use*, the Forest Service would have control over certain aspects of the operation, as defined in the stipulation attached to the lease. Examples might be road locations and design, drill pad placement, and the types and design of facilities on drill sites. Access for exploration may be restricted. Full field development could ensue following a successful find.

Controlled Surface Use would not mitigate the consequences as the primary factor that makes a roadless area a Roadless Area, is the lack of roads. Any road construction in a Roadless Area would result in loss of roadless recreation, visual resource, and Wilderness values of natural integrity, apparent naturalness, remoteness and solitude.

Timing Limitations: *Timing Limitations* generally would not mitigate the effects that could change the character of a Roadless Area. The presence of a road gives the user a different perception of the area and changes their expectations. A road gives the area a feeling that man has been there and has somehow altered the qualities of the area. *Timing Limitations* may, however, restrict use in the area to certain time periods and could mitigate some of the impacts that would occur as a result of a greater human presence.

Development associated with oil and gas activities results in direct loss of roadless character. The opportunity for that area to be added to the National Wilderness System in a roadless and undeveloped state is a foregone result.

Environmental Factor: Timber Lands Made Suitable

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no effect to timber lands made suitable. However, access provided to adjacent areas may allow for future timber sale.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: *Controlled Surface Use, Timing Limitations,* and *Standard Lease Terms* would generally allow road construction for oil and gas operations. The road may make areas that were not suitable because of high road costs, suitable and subject to future timber sales. The increased access would also allow for other management activities to take place, such as wildlife habitat improvements and control of insects, disease, and wildfire. The effects of timber harvest which could occur following oil and gas access are extensively documented in the Grand Mesa, Uncompahgre and Gunnison National Forest 1991 Forest Plan Amendment Final Supplemental Environmental Impact Statement.

Environmental Factor: Wildlife

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effects to wildlife and wildlife habitat in Roadless Areas.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: *Controlled Surface Use, Timing Limitations, and Standard Lease Terms* would change wildlife habitat characteristics significantly. Access provided into areas now roadless, would fragment existing blocks of older-aged forests. Wildlife species which thrive on edge ecosystems would be attracted. The cow bird, which moves in and then parasitizes other bird nests, is an example. The ecology of these areas would change as a result. Roads would provide access, bringing with it the associated negative effects on habitat effectiveness. (See discussion under Biological Diversity, pages IV-39 through IV-41.)

New road construction into previously unroaded habitat can be a very detrimental impact on big game and their habitat. Unroaded habitat is relatively undisturbed country and serves as a sanctuary for wildlife. These areas provide security habitat for all big game species and are relatively free of human related disturbances. As access is established in these areas, security is lost to a large extent. Permanent closure of these roads does provide renewed security, but not to the level of the area when it was unroaded.

Roads built and closed, would provide access corridors which would in turn be used by hunters and trappers on horseback, on bicycles, on ATV's, on snowmobiles and on foot. Traffic associated with simple maintenance and operation of producing wells would result in periodic and regular disturbance of what is now essentially undisturbed habitats. The roading and the access provided are especially detrimental to wildlife species which require large blocks of undisturbed habitat, such as wolverine, lynx and pine marten. The only way to regain security nearly equal to the historic levels, is to physically obliterate the road and recontour the slope.

Loss of security habitat found in the remaining unroaded slopes, would likely result in big game animals moving down onto private land earlier in the fall, compounding an increasing problem for private land owners and the Colorado Division of Wildlife (animal damage claims).

The Battlement Mesa Roadless Area contains critical habitat for Rocky Mountain bighorn sheep. Oil and gas activities in that particular Roadless Area could significantly reduce the habitat effectiveness of the area with direct effects on the herd itself.

Research Natural Areas

Environmental Factor: Proposed Tabeguache Research Natural Area

No Lease: *No Lease* would protect the intended use of a Research Natural Area. The Tabeguache is proposed to be designated as a Research Natural Area. *No Lease* would protect this area from potential oil and gas activity until it is formally designated a Research Natural Area. At that time, procedures to withdraw the area from mineral entry and mineral leasing will be initiated.

No Surface Occupancy: *No Surface Occupancy* would protect surface resources within the Research Natural Area from ground disturbing activity from oil and gas operations. However, Research Natural Areas are generally withdrawn from mineral entry and mineral leasing. This option would not be consistent with the Forest Service Manual direction to withdraw Research Natural Areas from mineral leasing.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: Any ground disturbance from oil and gas activity within a Research Natural Area would conflict with the intended uses of these areas (see Chapter III, page III-90).

Sensitive Areas

Environmental Factor: Recreation Opportunities

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no net change to recreational opportunities within Sensitive Areas.

Controlled Surface Use: With the measures specified to protect the visual resources, such as careful facility screening, the casual forest visitor would only be aware of oil and gas activity by seeing traffic associated with the activity. Generally, the on-the-ground facilities would not be readily visible. If industrial traffic volumes in these areas is greatly increased over levels prior to oil and gas activities, a perception of decreased recreational opportunities may be experienced by the recreationist.

Timing Limitations: Limiting oil and gas activities to periods of low recreation use would minimize the potential for conflict between the industrial use and recreational use of the area. However, there are also recreationists that use these areas that wait until the peak use season is over. *Timing Limitations* would do little to "protect" their recreational experience.

Standard Lease Terms: Visible oil and gas facilities may alter the recreational use in these areas. Previous perceptions of the area may be changed, which could result in changed or decreased use. The potential for conflict between the traditional recreational user of these areas and the industrial user would be greater.

Oil and gas activities in these areas may result in increased and improved access for the recreationist. The road systems may need to be improved to accommodate the mixed industrial and recreational traffic, resulting in not only a smoother, graded road, and increased recreational user comfort, but a changed recreational experience because of the road improvements.

Environmental Factor: Visual Resources

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no net change to Sensitive Areas.

Controlled Surface Use: *Controlled Surface Use* would consist of only allowing drill pad development and use when vegetative or land form screening exists, and therefore minimizing the visual impacts to the casual forest visitor from arterial and collector road system. This stipulation would still create a reduction in the quality of these Sensitive Areas. The *CSU* stipulation could also consist of limiting road use to established open roads; thereby maintaining the existing road character of the area.

Timing Limitations: *Timing Limitations* in this case would consist of limiting drill pad development to periods of low recreation use and therefore minimizing the conflict between industrial development and the general public. This stipulation would still result in a reduction in the visual quality of these Sensitive Areas.

Standard Lease Terms: Under the *Standard Lease Terms*, Sensitive Areas would potentially be significantly impacted by the presence of facilities (well pads, roads, pipeline corridors, and storage tanks) related to oil and gas exploration, development, and production.

Retention VQO

Environmental Factor: Visual Resources

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no net change to the Retention VQO portion of the visual resource.

Controlled Surface Use: *Controlled Surface Use* would allow drill pads to be sited where they would not alter the Retention VQO, and motorized travel would be limited to the existing open road system. With these measures, oil and gas activity would not be evident to the casual forest user, although some increase in traffic related to the activities may be apparent. This would generally maintain the VQO for these areas.

Timing Limitations: *Timing Limitations* would generally make no difference in terms of mitigation of consequences. The primary factors that change the VQO are related to the scale and amount of development, large commercial vehicles, and the visually sensitive recreationist; not the timing of the activity.

Standard Lease Terms: Under the *Standard Lease Terms*, a major portion of the Retention VQO areas would not meet their adopted visual quality, and the amount of Retention VQO in the analysis area would decrease. The presence of well pads, roads and related facilities would not meet the adopted Visual Quality Objective.

Retention VQO and Low VAC

Environmental Factor: Vegetation

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would protect the Visual Quality Objective.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: Removal of vegetation would result in the loss of screening in an area where maintaining existing screening is very

important. Roads and drill pads may become more visible to the casual forest user and may result in a reduced Visual Quality Objective and recreational experience.

Environmental Factor: Visual Resources

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would protect the visual resources and Visual Quality Objectives in these areas.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: *Controlled Surface Use*, *Timing Limitations*, and *Standard Lease Terms* would generally make no difference in terms of mitigating effects. The primary factors in maintaining the VQO of an area relate to the scale and amount of development, the capability of the land to absorb or recover from development, and the visually sensitive recreationist. Any ground disturbance in these areas would result in the Forest Plan adopted Retention VQO not being met.

Scenic Byway Corridors

No Lease and No Surface Occupancy: No leasing option would result in no net change to the Scenic Byway Corridors.

Controlled Surface Use: *Controlled Surface Use* would consist of 1) excluding drill pad development and operation in the foreground area seen from Scenic Byway Corridors, and 2) require all structures such as drill rigs, tanks, and buildings in middle ground seen areas to be colored to blend with the natural landscape. With this mitigation, the result would be no net change to the Scenic Byway Corridor as viewed by the casual forest user, i.e., the activities would not be readily apparent.

Timing Limitations: *Timing Limitations* could lessen the visual impacts related to oil and gas activity by scheduling activities during low recreational use periods. However, some oil and gas activity, such as operation and maintenance of the facilities, would occur year-round. Timing would not mitigate the effects from those activities, but those effects are also thought to be generally of little significance in Scenic Byway Corridors, i.e., one or two vehicles per day would not add appreciably to existing traffic levels in Scenic Byway Corridors.

Standard Lease Terms: *Standard Lease Terms* would not mitigate the effects to Scenic Byway Corridors. The primary factor that could change a Scenic Byway Corridor is the construction and operation of industrial facilities in an area promoted for its scenic attributes, and the high visual sensitivity of the recreational user of the byways. Oil and gas activities along these heavily used scenic/recreation routes would potentially result in decreased use, conflicts between users, and potentially adverse impacts to those communities dependent on tourism.

Semi-primitive Non-motorized (3A Management Areas)

Environmental Factor: Recreation Opportunities

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would not affect recreational opportunities in 3A Management Areas.

Controlled Surface Use and Standard Lease Terms: *Controlled Surface Use* and *Standard Lease Terms* would generally allow the construction of roads, well pads, and pipelines. Depending on whether or not oil or gas resources were found, these activities would potentially result in a change from the current Semi-primitive Non-motorized ROS class to a more developed ROS class. The number of acres of Semi-primitive Non-motorized ROS class on the Forest would also potentially be reduced.

With development, a reduction in the quality of the recreational experience would occur to the traditional users of the area and those seeking the Semi-primitive Non-motorized experience. The physical setting would potentially change from predominantly natural or natural appearing, to predominantly natural appearing with moderate evidences of sights and sounds of man.

Timing Limitations: *Timing Limitations* would not lessen the impacts significantly, because the presence of a road in a previously unroaded area, not the timing of the associated traffic or activities, is the primary factor that affects the recreation opportunities in 3A Management Areas.

Environmental Factor: Visual Resources

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would not affect visual resources in 3A Management Areas.

Controlled Surface Use: *Controlled Surface Use* would lessen the impacts to visual resources in 3A Management Areas if the stipulation contained provisions that would allow well pad siting where they would not alter the VQO and motorized travel would be limited to the established open road system in Retention VQO areas; and in Partial Retention VQO areas, only allow drill pad development and use in areas where vegetation or landform would screen the ground disturbance.

Timing Limitations: *Timing Limitations* would not mitigate the effects to visual resources in 3A Management areas.

Standard Lease Terms: *Standard Lease Terms* would potentially result in a change to the inventoried VQO in Retention and Partial Retention areas.

Environmental Factor: Timberlands Made Suitable

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no direct effects to timber suitability in 3A Management Areas. However, the availability of a road network on adjacent land may affect timber suitability in these areas.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: *Controlled Surface Use, Timing Limitations* and *Standard Lease Terms* would generally allow the construction of roads in 3A Management Areas. Roads constructed may make timber previously unsuitable due to high access costs, economically viable for timber harvest. This could result in a slightly higher ASQ for the Forest. Increased access could also allow for wildlife habitat management and the more efficient control of insects, disease, and wildfire.

Administrative Sites

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no effect to Forest Service Administrative Sites.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: *Controlled Surface Use, Timing Limitations* and *Standard Lease Terms* would make no difference in terms of mitigating effects, as the primary factor in change is the construction and operation of industrial facilities on a site developed for Forest Service administrative purposes. Oil and gas activity within an Administrative Site would interfere with the use of the site. Traffic, noise, and the general commotion around the drill site would disrupt administrative activity. These sites are typically less than five acres and would need to be relocated if a three acre well pad were to be constructed on them.

Recreation Complexes

Environmental Factor: Developed Recreation

No Lease: *No Lease* would result in no net change to the Developed Recreation Complexes.

No Surface Occupancy: *No Surface Occupancy* in this case, would consist of requiring drill pad development and use to be located at least 1 mile from developed facilities; therefore, limiting the noise from the drill pad operation in the Developed Recreation Complex. It is possible that during the APD stage, specific timing stipulation (time of day for operation) would also be determined to be needed in combination with this *No Surface Occupancy*.

Controlled Surface Use: *Controlled Surface Use* would not generally mitigate the effects of activity within a developed recreation site. The primary factor is the construction and operation of industrial facilities and its conflict with the high density recreational use of the area (see *Standard Lease Terms*).

Timing Limitations: *Timing Limitations* in this case would consist of limiting drill pad development to low recreation use periods or when the developed facilities are closed. This would minimize the conflict between industrial development and recreation use. For most recreationists, this would result in potential degradation of the developed facility experience/recreation quality from the mere presence of oil and gas production facilities at a developed recreation site.

Standard Lease Terms: Under the *Standard Lease Terms* the developed site experience/recreation quality would potentially be significantly impacted and use would potentially decrease. The noise, traffic, and general visual impact at the recreation site are the primary factors that would affect the quality of the recreational experience at developed recreation sites.

Environmental Factor: Dispersed Recreation

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no net change to the Dispersed Recreation Complex.

Controlled Surface Use: *Controlled Surface Use* would consist of 1) locating development outside of Dispersed Recreation Complexes and 2) limiting the use of motorized vehicles to existing roads in their current condition. This would limit the potential for major conflict with backcountry recreationists using the dispersed recreation sites. The backcountry (semi-primitive) character of the sites would generally be maintained.

Timing Limitations and Standard Lease Terms: *Timing Limitations* and *Standard Lease Terms* would not mitigate the effects of oil and gas activities at dispersed sites. The primary factors are development of drill pads and roads versus dispersed backcountry (semi-primitive) recreation. The presence of a road or well pad at a Dispersed Recreation Complex would change the physical setting and recreation experience at the site.

Environmental Factor: Major Trail Systems - Crag Crest NRT

No Lease: *No Lease* would result in no net change to the Crag Crest National Recreation Trail.

No Surface Occupancy: *No Surface Occupancy* consisting of drill pad development and use at least one mile away from the Crag Crest National Recreation Trail, would limit potential impacts to users of the trail. Trail users would be buffered from potential noise from operations on the well pad. Structures such as drill rigs, tanks and buildings that can be seen from a distance would be required to

be colored to blend with the natural landscape. Although the facilities may be visible, they would not dominate the landscape.

Controlled Surface Use and Standard Lease Terms: *Controlled Surface Use* and *Standard Lease Terms* would do little to mitigate the effects of oil and gas activities near the Crag Crest National Recreation Trail. Any ground disturbing or noisy activity within proximity of the trail would result in adverse impacts to the user experience and recreation quality. Trail use would potentially decrease.

Timing Limitations: *Timing Limitations* restricting oil and gas activity to the winter months, would mitigate some of the effects associated with oil and gas activity in the vicinity of the Crag Crest Trail. The trail user wouldn't hear the noise or see ongoing oil and gas exploration activity. However, some impacts to the visual resource in the form of road and pipeline corridors and well pads would potentially be long lasting and would be apparent during the trail's high use season.

Environmental Factor: Major Trail Systems - Cross Country Ski Trails

No Lease: *No Lease* would result in no additional effect to the cross country trail systems in the analysis area.

No Surface Occupancy: *No Surface Occupancy* within a 1/4 mile of a designated cross country ski trail (those discussed in Chapter III, pages III-96) would result in potential visual impacts to the recreation user of the trail. Depending on the extent of the facilities, the user would experience some degradation of recreation experience and may go somewhere else to ski, next time.

Controlled Surface Use: *Controlled Surface Use* mitigation measures over and above reasonable mitigation under *Standard Lease Terms*, would probably do little more to reduce the impacts to the trail user.

Timing Limitations: *Timing Limitations* restricting oil and gas exploration and development activities to May through November, would eliminate the potential conflict between industrial use of the area and recreational use of the area. The trail users and the oil and gas activity would occupy the trail corridor at different times of the year. The oil and gas activity would not directly affect the trail user. Ground disturbance would not be readily apparent to the trail user because of snow cover. Some facilities such as tank batteries and dehydration towers would be visible at the site if oil and/or gas resources are discovered.

Standard Lease Terms: *Standard Lease Terms* potentially would result in conflict between recreational and industrial use. If drilling operations took place during the winter months, the trail user would hear the sounds, see the sights, and possibly smell the odors associated with oil and gas drilling. This would result in decreased recreational quality and experience. Use may decrease as a result. After the drilling is complete, if oil and/or gas resources are found, some facilities would remain at the site. The presence of the facility near the trail corridor would potentially result in a changed physical setting, a decreased recreational experience, and decreased trail use.

Watersheds of Special Interest to Municipalities

Environmental Factor: Water Quality and Quantity

No Lease: *No Lease* would protect municipal watersheds from potential adverse impacts from oil and gas activity.

No Surface Occupancy: *No Surface Occupancy* would eliminate the majority of potential impacts to water quality. The lessee has the option of using directional drilling. There would be potential for groundwater contamination from directional drilling. High quality aquifers could be contaminated

from water from poor quality aquifers or drilling fluids, as a result of drilling operations. (See discussion under Groundwater, pages IV-48 and IV-50.)

Controlled Surface Use: Potential increases in sediment are likely even with the *Controlled Surface Use* restrictions identified in Appendix C (the *CSU* stipulation for Municipal Watersheds). These increases are likely to be very minor and generally of no real adverse impact to the value of these watersheds for domestic purposes. Of greatest concern are the risks associated with spills at the well pad or in transportation to and from the site. (Operators are required to have a Spill Prevention Control and Countermeasures Plan in place prior to any activity, designed to minimize potential impacts.) Also, sanitation assumes greater importance within municipal watersheds.

Timing Limitations: *Timing Limitations* would be applied during spring and fall periods when roads become saturated. This would lessen the potential for damage to the roads (mainly rutting), which would lessen the potential for accelerated erosion, sediment production, and turbid water.

Standard Lease Terms: *Standard Lease Terms* would result in a high probability that oil and gas operations would result in increased risk to the quality of municipal water supplies. Impacts would be primarily sediment associated with roads, well pads, pipelines and other surface disturbing activities. In addition, the risk of contamination due to spills and other accidents related to oil and gas exploration, development and production would be higher. Acquisition of water needed during drilling operations from onsite or nearby sources within the watershed would reduce the quantity of water delivered downstream to dependent communities.

Slopes 40-60%

Environmental Factor: Vegetation

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect to vegetation on Slopes 40-60%.

Controlled Surface Use: *Controlled Surface Use* would generally allow the removal of vegetation for road, drill pad, or pipeline construction. The use of erosion control measures and the saving of native vegetation would help speed the reclamation process. However, some of the effects described below for *Standard Lease Terms* would still occur.

Timing Limitations: *Timing Limitations* would not mitigate the effects on vegetation on Slopes 40-60%.

Standard Lease Terms: *Standard Lease Terms* would allow vegetation removal for the construction of roads, well pads, and pipelines. Loss of vegetation would likely also result in some loss of vegetation biodiversity. Revegetation usually uses a minimum number of species. Understory vegetation would be dominant until trees have been re-established on the site. Because of high erosion potential, revegetation efforts are also much more difficult on steep slopes.

Environmental Factor: Soils

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect on Slopes 40-60%.

Controlled Surface Use: *Controlled Surface Use* assures adequate mitigation measures would be applied to minimize soil erosion. The measures needed in these situations would be above and beyond *Standard Lease Terms* to keep erosion rates within tolerable limits, i.e., erosion would still occur, but would be at acceptable levels. This would be especially important near drainageways, ponded water areas, Riparian areas and Wetlands.

Timing Limitations: *Timing Limitations* would protect these high-erosion hazard sensitive soil areas during wet periods of time. Soils on Slopes 40-60% are extremely sensitive to accelerated erosion and sediment transport. Road construction and/or other activity that results in large soil disturbances, would be required to stop when the soils are saturated.

Standard Lease Terms: *Standard Lease Terms*, in most cases, would generally not provide adequate protection to control erosion at acceptable levels. The use of *Standard Lease Terms* could cause significant or permanent impairment of soil productivity, or result in large quantities of soil to be deposited in streams. As the slope steepens, the amount of soil disturbed for road, well pad or pipeline construction increases greatly (See Appendix F).

Environmental Factor: Visual Resources

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect on the visual resources on Slopes 40-60%.

Controlled Surface Use: *Controlled Surface Use* mitigation measures would take advantage, where possible, of topography and vegetation screening opportunities to lessen the overall visual impact of oil and gas operations and facilities. Some degradation of the visual resource would likely occur from the construction of roads, well pads, and pipelines that would be difficult to hide on Slopes 40-60%.

Timing Limitations: *Timing Limitations* would not mitigate visual impacts on Slopes 40-60%.

Standard Lease Terms: Any road, well pad, or pipeline construction on these slopes would result in an adverse impact to visual resources. Cut and fill slopes would be visible from long distances. The steeper the slope, the greater the visual impact.

Slopes > 60%

Environmental Factor: Vegetation

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect to vegetation on Slopes greater than 60%.

Controlled Surface Use: *Controlled Surface Use* would generally allow the removal of vegetation for any number of reasons (road, drill pad, or pipeline construction). The use of erosion control measures and the saving of native vegetation would help speed the reclamation process. However, some of the effects described below for *Standard Lease Terms* would still occur.

Timing Limitations: *Timing Limitations* would generally not mitigate the effects on vegetation.

Standard Lease Terms: *Standard Lease Terms* would allow vegetation removal for the construction of roads, well pads, and pipelines. Loss of vegetation would likely also result in some loss of vegetation biodiversity. Revegetation usually uses a minimum number of species. Understory vegetation would be dominant until trees have been re-established on the site. Because of high erosion potential, revegetation efforts are also much more difficult on steep slopes.

Environmental Factor: Soils

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect on Slopes greater than 60%.

Controlled Surface Use: *Controlled Surface Use* would result in excessive damage to the soil resource on these slopes. The slope of 60% is above or close to the angle of repose for most soil materials. Soil disturbance on Slopes greater than 60%, would result in a high potential for mass soil movement, soil erosion, and loss of soil productivity. Construction of a road or well pad on Slopes greater than 60% would result in an area that has been irreversibly and irretrievably disturbed. The site probably could not be restored to it's original ground contours without considerable time and expense.

Timing Limitations: The potential for soil erosion is so severe that *Timing Limitations* would do little to mitigate the effects of activities.

Standard Lease Terms: *Standard Lease Terms* would result in soil resource damage. Activities such as road, well pad, and pipeline construction would result in a greatly increased potential for soil erosion, mass soil movement, loss of soil productivity, and sedimentation. Cut slopes would reach deep into the soil profile and bedrock and would result in slopes that would be very difficult to revegetate.

Environmental Factor: Visual Resources

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect on the visual resources on Slopes greater than 60%.

Controlled Surface Use: *Controlled Surface Use* mitigation measures would take advantage, where possible, of topography and vegetation screening opportunities to lessen the overall visual impact of oil and gas operations and facilities. Some degradation of the visual resource would likely occur anyway from the construction of roads, well pads, and pipelines that would be difficult to hide on Slopes greater than 60%.

Timing Limitations: *Timing Limitations* would not mitigate visual impacts.

Standard Lease Terms: Any road, well pad, or pipeline construction on these slopes would result in an adverse impact to visual resources. Cut and fill slopes would be visible from long distances. The steeper the slope, the greater the visual impact.

Wildlife Special Habitats

Big Game Winter Range

Environmental Factor: Populations and Use

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would generally result in no additional effect to big game populations and use of their winter range. However, displacement of animals from adjacent areas may result in overuse and a potential decrease in carrying capacity.

Controlled Surface Use: *Controlled Surface Use* would lessen the impacts by restricting road use to operators and to periods when animals are not on winter range and restricting new road construction.

Timing Limitations: *Timing Limitations* would lessen the impacts by restricting oil and gas activities during winter when animals are on their winter range.

Big Game Winter Range	December 1 to April 30

Exploratory and development operations would be restricted to periods when animals are not on the ranges. Maintenance activities would be limited to periods of the day when animals are less active (e.g. 10 a.m. - 2 p.m.).

Standard Lease Terms: Critical life cycle periods include wintering times. Activity such as blasting and helicopter traffic during a species critical life cycle period can be very crucial to the survival of some individuals, especially young. Disturbance during any of these time periods can cause displacement from preferred, optimum, or secure habitats to marginal habitats lacking the elements necessary for their survival. Activity of any kind during critical periods causes stress and unnecessary expenditure of energy reserves. Increased mortality may be a direct result because of energy reserves lost, increased chances of predation, or accidents resulting from disbursement. Road, well pad, and/or pipeline construction in winter range would result in a potential loss of winter range habitat and a decrease in the carrying capacity. Increased stress and harassment on big game species would occur without seasonal limitation protection during the winter months. Crucial winter range habitat would be lost without replacement (BLM, 1991).

Environmental Factor: Habitat Condition

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect to the habitat condition on Big Game Winter Ranges.

Controlled Surface Use: *Controlled Surface Use* would likely result in some disturbance and removal of vegetation. This would result in a potential loss of security cover. There would also be a potential loss of habitat carrying capacity if animals displaced by activities on adjacent lands use these areas.

Timing Limitations: *Timing Limitations* would not lessen the impacts of the potential loss of security cover.

Standard Lease Terms: *Standard Lease Terms* would likely result in some disturbance and removal of vegetation. This would result in a potential loss of security cover. There would also be a potential loss of habitat carrying capacity if animals displaced by activities on adjacent lands use these areas.

Elk Calving Areas

Environmental Factor: Populations and Use

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would generally result in no additional effects to elk calving areas. However, displacement of animals from adjacent areas may result in increased habitat use and animal stress.

Controlled Surface Use: *Controlled Surface Use* would lessen the impacts on elk calving areas by restricting road use to operators (close roads to the public), by restricting new road construction and by relocating roads where terrain or vegetation will provide a buffer between activities and the critical habitat.

Timing Limitations: *Timing Limitations* would lessen the impacts by restricting oil and gas activities during calving periods:

Elk Calving	April 16 to June 30

There would be little direct effect if activities take place outside these time periods.

Standard Lease Terms: *Standard Lease Terms* would result in the displacement of animals to less desirable birthing areas or areas already occupied. This would potentially result in increased stress and possible mortality. Human activity along roads through these areas would have a similar effect.

Significant impacts resulting from oil and gas development could occur to big game species during the birthing seasons if timing restrictions allowed by *Standard Lease Terms* are not long enough to cover these periods.

Environmental Factor: Habitat Condition

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect to the habitat condition in deer and elk birthing areas.

Controlled Surface Use: *Controlled Surface Use* would likely result in some disturbance and removal of vegetation. This would result in a potential loss of security cover. There would also be a potential loss of habitat carrying capacity if animals displaced by activities on adjacent lands use these areas.

Timing Limitations: *Timing Limitations* would not lessen the impacts of the potential loss of security cover.

Standard Lease Terms: *Standard Lease Terms* would likely result in some disturbance and removal of vegetation. This would result in a potential loss of security cover. There would also be a potential loss of habitat carrying capacity if animals displaced by activities on adjacent lands use these areas.

Migration Routes and Staging Areas

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effects to Migration Routes and Stating Areas.

Controlled Surface Use: *Controlled Surface Use* would protect Migration Routes and Stating Areas by controlling locations of new road, well pad, or pipeline construction in the main animal travel corridor. The effects would be lessened because the oil and gas activity would be moved to the fringes of this habitat.

Timing Limitations: *Timing Limitations* during high use periods:

Migration Routes	March 1 to May 30 November 1 to December 31
Staging Areas	October 15 to December 31

would effectively mitigate the disturbance and displacement of the animals.

Standard Lease Terms: *Standard Lease Terms* would result in potential disturbance to the animals during critical periods. This could lead to avoidance and increased stress and mortality. Disturbance may displace big game off-Forest earlier than normal, and could result in damage to private property and claims against the Colorado Division of Wildlife.

Bighorn Sheep Lambing and Breeding Areas

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect to bighorn sheep lambing and breeding areas.

Controlled Surface Use: *Controlled Surface Use* would lessen some of the effects on bighorn sheep lambing and breeding areas by closing roads to public travel and obliteration of roads when the oil and gas activities are completed.

Timing Limitations: *Timing Limitations* during high use periods would lessen the disturbance and displacement of bighorn sheep.

Bighorn Sheep Lambing	May 1 to July 15
Bighorn Sheep Breeding	November 1 to January 1

Standard Lease Terms: *Standard Lease Terms* would likely result in some disturbance to bighorn sheep lambing and breeding areas. Vegetation removal from the construction of roads, well pads, and pipelines would potentially result in loss of this important habitat. Disturbance during critical periods could result in avoidance, increased stress and mortality. Habitat loss and additional stress on the already weakened herd in the Battlement Mesa area may lead to its demise.

Summer Range (Concentrated Use)

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effects to summer range.

Controlled Surface Use: *Controlled Surface Use* would lessen impacts to areas of concentrated use summer range, by controlling road location, closing oil and gas roads to public travel and by obliterating roads after the activity has been completed. Impacts to summering herds would lessened, but there would still be potential for disturbance and displacement off Grand Mesa and onto private land.

Timing Limitations: *Timing Limitations* during high big game use periods would lessen the disturbance and displacement of the animals.

Standard Lease Terms: *Standard Lease Terms* would result in an increase in the potential for disturbance to the animals. Summering animals are subject to disturbance from other activity in their summer range, such as timber harvest, livestock grazing, ATV/ORV use, and increased auto touring in the Forest. Oil and gas activity in these areas, in addition to the other activities, could result in increased stress, mortality, habitat abandonment and displacement off their summer range and onto private property earlier than is desirable from a wildlife management perspective.

Sage Grouse Leks

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effects to Sage Grouse Leks. Protection with a *No Surface Occupancy* stipulation would encompass the entire lek and a one-half mile around the lek. Lek sizes vary with the size of each population; therefore, *NSO* stipulation could vary from a minimum of one-half mile radius to six miles radius on the larger lek sites.

Controlled Surface Use: *Controlled Surface Use* would require the use of the existing road systems within the nesting habitat around a lek. Road locations would be controlled. This would lessen the potential for impacts to sage grouse, directly, or through habitat destruction.

Timing Limitations: *Timing Limitations* would lessen the potential for adverse impacts to Sage Grouse Leks during the breeding and nesting periods.

Sage Grouse Lek Activity	March 1 to May 31

Standard Lease Terms: *Standard Lease Terms* would not provide any special consideration for the protection of Sage Grouse Leks. There would be a potential loss of habitat from the construction of roads, well pads, and pipelines. Increased human disturbance from oil and gas activity would potentially result in avoidance of the area, a reduction in breeding, and a decrease in reproduction and population.

Threatened, Endangered and Sensitive Species

All oil and gas activities are subject to the provisions of the Endangered Species Act. To comply with the requirements of the Endangered Species Act, all oil and gas activities would be cleared for species occurrence, prior to ground disturbance at the operational stage (APD's), on a case by case basis, rather than at the leasing stage. Oil and gas exploration and development has the potential to adversely affect threatened, endangered, and sensitive plant and animal species on the Forest unless species and their habitat are protected where they are known to occur, and provisions are made to protect new populations, new species, and new habitat when located.

Threatened and endangered species are protected by law, regardless of lease stipulations. Therefore, the use of a lease stipulation to protect them is not necessary. Where biological evaluations indicate that these species could be adversely affected, appropriate measures would be required to prevent impacts.

The Colorado River cutthroat trout is a USFWS Category 2 candidate species. The Forest is currently in the process of cooperating with CDOW in preparing a conservation plan designed to keep this species from becoming listed. While there are two populations which have been established in areas outside the analysis area, and none are known to exist within the analysis area, there is a significant amount of suitable habitat available within the area and these sites will have to be evaluated prior to any activities being approved.

The peregrine falcon (endangered), Mexican spotted owl (candidate species), ferruginous hawk (candidate species) and the bald eagle (endangered) are highly susceptible to disturbance at their nesting sites. Disturbance during the nest building, egg laying, and egg incubation periods can easily cause the abandonment of all nesting activities. At the present time there are no known nests of these species on the Forest. Except for some spotted owl surveys on the Uncompahgre Plateau, there have been no intensive surveys done for these raptors.

However, some restrictions around known nesting and/or roosting sites are required for peregrine falcons, bald eagles, Mexican spotted owls, and ferruginous hawks. They are:

> Peregrine falcon: No activity within a half mile of a nesting area from March 16 through July 31.
>
> Bald eagle: No activity within a half mile of a nesting area from February 15 through June 15 and no activity within a half mile of a roosting area from November 16 through April 15.
>
> Mexican spotted owl: No activity in the core area of 1480 acres around a nest site from February 1 through July 31.
>
> Ferruginous hawk: No activity within a half mile of a nesting area from March 1 through July 31.

Bald eagle roosting sites can be found along all the major river bottoms, both on and off the National Forest. Restrictions are necessary to protect bald eagle courtship behavior and nesting habitat. This time period is extremely sensitive to human disturbance and may cause nest abandonment and desertion of long established nesting territories. Bald eagle winter roosting sites are extremely important to

sustaining bald eagles over the winter months when food supplies are severely limited. Buffer strips around these areas are essential to the maintenance of bald eagle habitat.

Peregrine falcon cliff nesting complexes require restrictive stipulations because of the sensitivity of these areas to disturbance and desertion. Buffer zones must be established around these areas to adequately protect the nesting sites. Probably the biggest threat to these species is the potential disturbance to nesting territories from exploration and road construction to proposed development sites.

The Mexican Spotted Owl has been proposed for listing as a threatened species to the U.S. Fish and Wildlife Service. Management guidelines and restrictions will be used to protect the Mexican spotted owl. Potential Mexican spotted owl habitat has been mapped in the Lone Cone area and on the Uncompahgre Plateau. Some surveys have been conducted in the area, but more need to be completed. When spotted owl nesting territories have been located, they will be protected by establishing core habitat areas. These core habitat areas will consist of nesting, feeding, and roosting areas and are not considered to be overlapping. Where Mexican spotted owls are sighted, seismic and surface disturbing activities may be restricted within the 450 acres of the total territory of 2000 acres (Fletcher, 1990). In the remaining area, other surface activities may be allowed pending impact assessments through the NEPA process. In areas where a confirmed nest and roost site is identified, all surface management activities will be limited. The core area of a confirmed nest site is 1,480 acres where surface disturbance activities are restricted.

One plant species, the Spineless Hedgehog cactus, has been found on Grand Mesa and may also be found on the Uncompahgre Plateau. Locations where this plant are known to occur must be protected from any surface disturbing activity. As with any other proposed, threatened, or endangered species, a survey will be necessary when any site specific proposal for oil and gas exploration or development proposal has been filed.

The boreal toad could be adversely affected by any road or drill pad construction, if it is above 9,000 feet and in or near any wet bogs or ponds. North American wolverine and lynx may inhabit the Forest and their habitat would be dramatically degraded with the construction of any new roads in previously unroaded habitat. These are backcountry "roadless" type species that are very sensitive to the presence of man. Any new road construction proposals need address these two species. These two species and their habitats would also be affected by cause and effect connected actions such as possible logging of forested stands, as a result of roads constructed for oil and gas activities. Increased trapping of these two furbearing species could also occur as a result of easier access to their habitat, even if roads are closed to vehicle travel.

The possibility exists that additional inventories will be required to document the presence or absence of any proposed, threatened, endangered, sensitive, or candidate species. These inventories will be conducted prior to the issuance of any APD where the potential exists that any of these species may occur in the area. Specific inventories may be required in lease areas, prior to any development. Provisions in the oil and gas lease provide for requiring inventories so that activities can be relocated to avoid threatened, endangered, and proposed listed Federal species of animals and plants. Locations of previously inventoried species in these categories are afforded protection through *Timing Limitations* and *No Surface Occupancy* stipulations on the lease.

Utility Corridors / Electronic Sites

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no net change to Utility Corridors or Electronic Sites.

Controlled Surface Use: *Controlled Surface Use* would exclude the location of drill pads within a Utility Corridor and would therefore maintain the corridor for additional utilities and minimize

conflicts between drill towers and power transmission lines. (Road use and construction would still be allowed.)

Electronic sites are managed under special use permits. Oil and gas activity could create magnetic interference and could potentially interfere with the current use of Electronic Sites.

Timing Limitations and Standard Lease Terms: *Timing Limitations* and *Standard Lease Terms* would not mitigate the potential for impacts and conflicts between intended uses of Utility Corridors. Drill towers may present a safety problem if allowed within a Utility Corridor.

Primary Rangeland (6B Management Areas)

Environmental Factor: Vegetation

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would result in no additional effect to vegetation in Primary Rangeland.

Controlled Surface Use: *Controlled Surface Use* limiting activity to the existing road corridors would mitigate the effects to vegetation in Primary Rangeland. Little additional ground disturbance or vegetation removal would occur.

Timing Limitations: *Timing Limitations* would not mitigate the effects of ground disturbance and vegetation removal.

Standard Lease Terms: *Standard Lease Terms* would allow the removal of vegetation for roads, well pads, and pipelines. This removal of vegetation would result in a loss of forage, range carrying capacity, and sensitive plant associations. A potential increase in the spread of noxious weeds or less desirable vegetation would also potentially occur.

Environmental Factor: Livestock Grazing

No Lease: *No Lease* would continue the status quo, with livestock grazing occurring on the suitable rangeland areas without the disturbance of development and construction activities. Rangeland stocking capabilities would be determined by the use of undisturbed plant communities and appropriate management system. Conflicts with wildlife for forage carrying capacity would not be accelerated. Opportunities for ease of facilitating large structural range improvements and permittee administration would be negated as a result of no additional road access.

No Surface Occupancy: *No Surface Occupancy* would generate minimal impact on livestock grazing. Any anticipated impact would be generated from those areas where the *Affected Environment* would be disturbed. Opportunities foregone and stocking considerations would be similar to those described under *No Lease*.

Controlled Surface Use: *Controlled Surface Use* would generally not mitigate the resource disturbing impacts associated with normal oil and gas leases such as road, well pad, and pipeline construction. Such impacts affect livestock grazing. However, *Controlled Surface Use* could limit resource disturbing impacts to existing roads. This would result in a minimal impact to livestock grazing.

Timing Limitations: *Timing Limitations* from from June 1 through October 15 would mitigate the impacts on livestock grazing from people oriented and equipment related disturbances. Specific impacts could in part, be mitigated by coordinating grazing use to avoid oil and gas activities for temporary periods of time. Such impacts are considered minor when contrasted to the resource disturbing impacts of vegetation removal originating from road, well pad, and pipeline construction.

Standard Lease Terms: *Standard Lease Terms* allowing road, well pad, or pipeline construction would impact livestock grazing. In some situations, forage loss would be temporary, provided reclamation measures are successful in restoring the disturbed environment. In other cases, reclamation could result in satisfactory forage and ground cover, but some loss of sensitive plant associations may not be mitigated, due to ecosystem disturbance associated with vegetation and soil loss.

Road access which intercepts existing allotment and division fences, would require placement of cattle guards and gates. Road construction which results in cut banks in excess of two feet may serve as impediments to the movement of livestock. It may also result in difficulty in restoration of plant cover on overused cut and fill slopes, and may funnel livestock into areas of low vegetative productivity or sensitive soil. Road construction, as well as drill pad disturbance, removes the native plant association and opens up the soil, thus reducing native plant competition and promotes the introduction of less desirable plants or noxious weeds. Any activity resulting in ground disturbance would require desirable plant seed introduction within a month of disturbance.

Full field development would accentuate the existing conflict for forage between wildlife and livestock. Stocking levels of both wildlife and livestock may require adjustment, contingent upon the specifics and the extent of the desired development. However, full field development would also facilitate access and may enhance water development and transmission possibilities. Range administration for both the permittee and the land manager would be positively facilitated by improved access. But, opportunities for vandalism, livestock theft, and conflict with recreation users would also increase.

Lands Suited for Timber Harvest

Environmental Factor: Timberlands Made Suitable

No Lease and No Surface Occupancy: *No Lease* and *No Surface Occupancy* would not effect the suitability of timber.

Controlled Surface Use, Timing Limitations and Standard Lease Terms: *Controlled Surface Use, Timing Limitations* and *Standard Lease Terms* would result in similar effects. Access to areas previously delineated as not suitable for timber harvest because of cost prohibitive road construction, would or could become suitable if a road was built for oil and gas activity. This could result in a slightly higher Forest ASQ (would first require environmental analysis and a Forest Plan amendment). Access would also allow other forest management activities such as prescribed burning for wildlife habitat enhancement and the more efficient control of insects, disease, and wildfire.

Environmental Consequences of Alternatives

The environmental consequences of the various alternatives relate to the anticipated seven (7) wells that will be drilled on new leases. The environmental consequences of the predicted forty (40) wells that may be drilled on existing leases are discussed in the Cumulative Effects sections under each *Affected Environment*.

General Forest

This section describes the environmental consequences of program Alternatives, as described in Chapter II, on the General Forest environment. For an understanding of the overall organization of this chapter, refer to the description of the analysis process in Chapter I.

Environmental Factor: Biological Diversity

In the simplest of terms, biological diversity is the variety of life and its processes. It includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur. Biological diversity is comprised of genetic diversity, species diversity, and community diversity. Conserving biological diversity includes perpetuating all native species in numbers and distributions that provide a high likelihood of continued existence. The increased number of threatened and endangered species indicates a loss of genetic variability and a decline of natural communities. Species extinction is only the most extreme manifestation of the loss of biological diversity. Biological diversity declines with the loss of genotypes of populations, reductions in the distribution and abundance of species, and the elimination or degradation of natural communities. Natural communities that once covered immense areas have been largely reduced to fragments. Biological diversity is best exemplified by natural biological ecosystems that have not been altered or manipulated by humans. Biological diversity will be affected by all the alternatives, to varying degrees. Alternatives which will result in the issuance of oil and gas leases in existing Roadless Areas will have the greatest adverse impact and loss of biological diversity in natural ecosystems. Roading of these areas will result in the irretrievable loss of natural ecosystems. These areas are refuges of natural plant and animal populations that provide genetic variability, species and community variety of plants and animals. These areas, especially where they are adjacent to other Roadless Areas or Wilderness, are especially important as potential habitat for extirpated populations of once native species such as the peregrine falcon, bald eagle, gray wolf, grizzly bear, river otter, wolverine, lynx, Colorado River cutthroat trout, Uncompahgre fritillary butterfly, spineless hedgehog cactus, and other animal and plant species. Many of these species require large home ranges of natural habitats unaltered by humans. Protection of these roadless lands from any development, including oil and gas development, will help maintain these species where they are still present and will provide potential re-introduction sites for species that have been extirpated. The effects are briefly discussed for each of the alternatives.

Developed areas where vegetative manipulation has occurred will often also support a large number of plant varieties. However, these areas are often invaded by plants which are not native. While this increases the diversity in numbers of plant species, this increase in variety is usually to the detriment of the native plant populations. Increases in younger age classes of forest vegetative types would occur in areas where oil and gas roads were used to harvest mature or old growth forest stands. Young stands would replace the mature stands, causing a temporary shift of vegetation into younger age classes. This would result in an increase in some wildlife species dependent on the more open vegetative cover at the expense of species dependent upon mature or old growth ecosystems. These younger age class stands tend to have more human activity. The shift in vegetative age classes would see a corresponding shift in animal species from those less tolerant of human activity to more tolerant species. Species benefited by roading and subsequent timber harvest are not species that are in declining states throughout their range.

Alternative 1 - No Action Alternative

Under this alternative all Roadless Areas would be leased with only the *Standard Lease Terms* option. All of these Roadless Areas could be lost as existing natural communities and would be lost as potential re-introduction sites for native indigenous species which have been extirpated or drastically reduced in number. Short term increases in early successional stage dependent plants and animals may occur where timber harvest follows as a result of roading activity for oil and gas development. This alternative would be detrimental to biological diversity.

Alternative 2 - Preferred Alternative

Under this alternative, the Kannah Creek, Roubideau, Tabeguache, Whetstone Mountain, Flat Top Mountain, parts of Priest Mountain (Flat Tops, et al), West Elk (Snowshoe Mesa, Kebler Pass), Raggeds (Kebler Pass) and Battlement Mesa Roadless Areas would be maintained as natural communities. The remaining Roadless Areas could be lost as existing natural communities and potential re-introduction sites for threatened or endangered species if oil and gas development does occur. Short term increases in some plant and animal species dependent upon early successional stage vegetation may occur where road construction or timber harvest occurs in Roadless Areas not protected by the *No Surface Occupancy* stipulation and/or not available for oil and gas leasing.

Alternative 3 - No Lease

Under this alternative all of the Roadless Areas would remain in a natural roadless state, as far as oil and gas development is concerned, and would provide habitat for those species that currently reside there and could potentially provide habitat for species that may be re-introduced in the future. This alternative would benefit biological diversity in natural ecosystems by maintaining these habitats.

Alternative 4 - Lease with Standard Lease Terms

Under this alternative, no Roadless Areas would be protected from development and impacts would be similar to Alternative 1 in adverse effects on biological diversity. All of these Roadless Areas could be lost as natural communities and as potential re-introduction sites for threatened or endangered species. This alternative would be extremely detrimental to existing biological diversity.

Early successional stage dependent species of plants and animals would benefit because of Roadless Areas potentially being made available for timber harvest activities. These Roadless Areas would be susceptible to the invasion of noxious weeds and undesirable vegetation as a result of vehicle access.

Alternative 5 - No Lease in Roadless and SPNM

Under this alternative, all of the Roadless Areas would remain in a natural roadless situation, as far as oil and gas development is concerned, and would provide habitat for those species that currently reside there and could potentially provide habitat for species that may be re-introduced in the future. This alternative would be very beneficial to biological diversity in natural ecosystems by maintaining these habitats.

Cumulative Effects

The leasing of any Roadless Area to oil and gas activity will significantly change the natural character of the area because of the road access that is necessary to conduct oil and gas activities. The cumulative impact resulting from potential oil and gas activities on existing leases, the subsequent connected actions of timber harvest, increased human use, recreational developments, and trapping as a result of the road will forever change the area as a natural community. Species like the goshawk, pine marten, lynx, wolverine and many others are very dependent on these areas as the core area of their

home ranges. Entering into these areas, combined with all the other Forest activities going on in adjacent areas, would continue the loss of habitat for these species, which is necessary for their survival.

Several wildlife species would benefit from oil and gas development and subsequent timber harvest activity. Red-tailed hawks would benefit from clearcutting activity in aspen stands. However, the red-tail hawk is increasing in numbers throughout it's range. Goshawks, which depend on mature aspen stands, would be negatively impacted by clearcutting, and this species is declining throughout it's range.

Environmental Factor: Vegetation

Disturbed acres and reclaimed acres for the projected Reasonably Foreseeable Development are discussed in the analysis assumptions in Chapter II.

Clearings for oil and gas wells, roads, and pipelines directly affect the forest vegetation resource. Post-leasing activities would cause a minor, short-term loss of timber on cleared areas for an estimated four to forty-four years. Tree planting would be required on sites suitable for timber harvest, if conditions are not naturally conducive to obtaining minimum stocking within five years after well abandonment. The Forest Plan identifies land suitable for timber harvest. Cleared sites would also be temporarily out of production for livestock and wildlife forage, reducing visual quality, plant and animal diversity.

The RFD predicted activity and general locations of wells would not cause a significant effect on the forest vegetation. Disturbed acres would be a minor portion of unsuited as well as suited lands for timber harvest.

All alternatives which would authorize leasing of National Forest lands would result in a short-term loss in grass, forb, timber, or other vegetative production. Although the production may be lost from four to forty-four years, additional access may be gained for vegetative treatment activities, to provide wildlife habitat, visual quality, wood fiber production, plant and animal diversity, and control of insects, disease and wildfire.

Because of the relatively small number of acres potentially affected, relative to the size of the analysis area overall, the losses are not considered to be significant under any of the alternatives analyzed. Areas which are expected to be affected would be representative of the general forest since the projection is for seven wells on new leases.

Alternative 1 - No Action,
Alternative 2 - Preferred,
Alternative 4 - Lease with Standard Lease Terms, and
Alternative 5 - No Lease in Roadless and SPNM

These alternatives would result in about 75 acres disturbed (7 wells and 10.7 acres/well disturbed, see Analysis Assumptions, page II-1). The location of the wells may vary, but the extent of impact to vegetation from disturbance should be similar. Areas which are classified in the Forest Plan as appropriate suited lands and are currently not managed due to high road system cost, may have a road system developed by the oil and gas activity which may make the area economically viable for timber harvest. Any activity within this land classification may increase the Allowable Sale Quantity, slightly. Activity within suited lands may become more viable for vegetation management activities, due to a more extensive road system.

Conflicts between the public, timber purchasers, and oil and gas lessees regarding road use and maintenance, would arise in areas where coincidental activities occur during oil and gas development. Lands which are in timber sales or other vegetation management contracts may also be under an oil and gas lease. Conflicts would occur with coincident operations relating to such aspects as harvest, hauling, road building, and timing of operations.

Alternative 3 - No Lease

This alternative would create no change to the coniferous or deciduous forest environment resulting from expanded leasing. The aspen areas classified in the Forest Plan as appropriate suited lands which are currently not managed due to high road system cost, would remain in the natural state. Management on these areas for wood fiber production, wildlife habitat, visual quality, plant and animal diversity, and control of insects, disease and wildfire would continue to be curtailed.

Conflicts between the public, timber purchasers, and oil and gas permittees regarding road use and maintenance would not occur.

Cumulative Effects

The combined effects of 47 wells are similar in individual scope to the effects of the seven wells previously discussed, with regard to forest vegetation. The total cleared acres would be greater, and therefore the effects of the additional wells would be expanded proportionately.

The effects of an additional seven wells to be drilled on new leases would not likely result in adverse cumulative effects. Forty of the 47 wells are predicted to be drilled on existing leases or in unitized areas. An average of 10.7 acres of land is assumed to be disturbed per well, for well pads, roads, and pipelines (see Analysis Assumptions, page II-1), for a total of 428 acres of land disturbed of vegetation, in the short-term. Not all of this would be disturbed at one time however, as the RFD projection is for activity over the next 15 years. Some revegetation would be expected to occur between the first and the last of the 47 wells drilled. Projected oil and gas activity on existing leases would result in an estimated 29 acres per year, of ground disturbance. The analysis area consists of nearly 1 million acres. The seven additional wells would result in another 75 acres of ground disturbance (5 acres per year). This clearing represents approximately five hundredths of a percent (0.05 %) of the analysis area. To put these figures in perspective, timber sales on the Forest in the next 15 years would result in approximately 110,985 acres disturbed from current and planned (in Forest Plan) timber harvest and timber sale roads. Any potential increase in the ASQ would result in a commensurate increase in impacts to vegetation.

Environmental Factor: Soils and Geology

Oil and gas construction activities heavily impact the soil resource at the point and area of disturbance. The specific impact depends on the activity, the soil characteristics at the site, the geomorphic and topographic relationships, basic position, and climatic conditions. In most cases construction activities result in displacement, compaction, and mixing of the soil material. It may increase the potential for accelerated erosion in the forms of sheet, rill and gully erosion, and may lead to slope failures such as earthflows, mudflows, debris flows and various forms of landslides. Since the precise location of the RFD projected activities is unknown at this level of analysis, the description of the effects on the soil resource are general in nature. Basically, the more area disturbed, the higher the potential for detrimental soil alterations.

Alternative 1 - No Action

Wherever activities occur, under this alternative, some affected soil environments could be severely altered. Although *Controlled Surface Use* would be specified for Riparian areas and Wetlands, the effects should be the same as *No Surface Occupancy*, due to the requirements of the regulations, i.e., activity in Riparian areas and Wetlands must be approved in the Surface Use Plan of Operations.

The fact that high erosion hazard areas would be *Controlled Surface Use* would help maintain soil damage by erosion, to within tolerable limits. However, on the flanks of Grand Mesa and in the Muddy Basin area of the Paonia Ranger District, special facility design may be required, due to the finer textured soils and potentially higher erosion situations that occur.

Alternative 2 - Preferred

Wherever oil and gas construction activities occur, the soil resource would be impacted. This alternative however, recommends *No Surface Occupancy* for the sensitive soil areas of Riparian and Alpine/Tundra environments. This would prevent these activities from causing irreversible and irretrievable damages. This is based on the very logical and recognized soil and water conservation concept of avoiding extremely sensitive areas.

Alternative 3 - No Lease

This alternative would result in no additional disturbance to soil resources. Based on the RFD, the seven wells predicted to be drilled on new leases, would not be drilled. Soil productivity would be maintained and resources would not be needed to bring areas back into vegetative productivity or used to control erosion.

Alternative 4 - Lease with Standard Lease Terms

For the proposed seven new wells that may occur throughout the analysis area, the use of *Standard Lease Terms* would cause disturbances in sensitive soil areas that would result in unacceptable soil resource damage. These sensitive areas need measures that are above and beyond *Standard Lease Terms,* to control and mitigate soil damage. Without the extra measures, damage to the soil would potentially exceed tolerable limits. The result would be an area that is irretrievably and irreversibly altered.

Alternative 5 - No Lease in Roadless and SPNM

This alternative would result in no additional effect to soil resources in identified Roadless Areas. Outside Roadless Areas, the effects would be similar to those discussed in Alternative 2.

Cumulative Effects

Cumulative soil impacts could occur in areas where large concentrations of wells are predicted. The area with the highest potential for detrimental damage to soils is the participating areas of the Ragged Mountain Unit. There is a moderate to high potential for detrimental soil damage to occur in the high potential areas of Grand Mesa and the North Fork of the Gunnison, and the Petro leases. The soils in these areas are also fine textured and susceptible to slumping, but less activity is estimated to occur in them. The lowest potential for detrimental soil damage to occur is in the moderate potential on Grand Mesa, the Narrows unit, the Naturita, and Uncompahgre-Lone Cone areas. The soils in these areas are slightly less susceptible to damage, but also the amount of projected activity is very small.

Significant soil resource damage may occur in sensitive soil areas already leased. Based on development assumptions this may occur on 40 well sites throughout the area. The areas subject to a high potential for significant soil resource degradation will be the areas with the highest concentrations of activities. This would mainly be within the Grand Mesa and Gunnison National Forest areas of the analysis area.

Environmental Factor: Air Quality

Air pollution is controlled through the National Ambient Air Quality Standards and permit requirements established under the Federal Clean Air Act and is administered by the Colorado Department of Health. The primary air contaminants associated with oil and gas activity on the Forest are: dust from construction and traffic; diesel fumes from heavy equipment operations and drilling rigs; and combustion by-products from the flaring of gas during testing operations.

Air pollutants generated by oil and gas activities are expected to have minimal effects on local or regional air quality. With the exception of the no new lease alternative, all alternatives are expected to have the effects described below. The no new lease alternative will have no additional impacts to the air resource. Air quality impacts would occur from activity on existing leases under all alternatives.

Economic activity and population growth as a result of the projected oil and gas activity on the Forest, as discussed elsewhere in the EIS, would be insignificant and not likely to affect air quality in Class I and II airsheds.

NAAQS Criteria Pollutants

Carbon Monoxide: Sources of carbon monoxide related to oil and gas activity are limited to motor vehicles, slash burning, and the flaring of waste gas. All of these sources are minor in number and duration. Those non-attainment areas for carbon monoxide within 50 km of the analysis area would not likely be affected by any carbon monoxide created as a result of oil and gas activity. Their air quality episodes typically occur in the winter (ski season), while most oil and gas activity will occur from late spring through fall.

Ozone: No high concentrations of ozone would be expected to occur as a result of oil and gas activity. Some minor sources of the components necessary for the production of ozone may be produced as a result of oil and gas activity. The concentrations would not likely exceed National Ambient Air Quality Standards. Ozone problems are not typically found associated with a rural mountainous environment far from a major urban area with few local sources of reactive hydrocarbons and nitrogen oxides.

Nitrogen Dioxide: Nitrogen dioxide would likely be emitted in short-term intervals during the flaring process described below for sulfur dioxide.

Sulfur Dioxide: Waste gas flaring is a common practice during the completion and testing phases of drilling. It is not typically done after the well is connected to a pipeline. Oil wells more commonly flare gas, but that practice is discouraged by the BLM to conserve resources. The majority of the wells on the Forest are expected to be gas wells. Flaring usually lasts a day or two, but could last as long as a week. Sulfur dioxide is typically not associated with the flaring of gas from wells on the Forest because of the very low sulfur content of gases produced from the wells.

Hydrogen sulfide (H_2S) has not been noted in the wells drilled on the Forest. If it would occur, it would likely be in low concentrations. Disposal of low concentrations of H_2S is usually accomplished by flaring. If flaring of H_2S occurs, sulfur dioxide will be produced in the flaring process. Onshore Order #6 (BLM regulation 43 CFR 3160) addresses the requirements for conducting operations in a hydrogen sulfide environment and the release of sulfur dioxide during flaring.

Particulate Matter (PM10): Particulate emissions vary substantially from day to day, depending on the level of activity, the specific operations, and the weather. However, the concentrations would not likely affect air quality at any of the monitoring sites scattered in and around the analysis area, nor would air quality in Class I airsheds be adversely affected. Localized effects may occur immediately adjacent to the sources of the particulates, i.e., next to a road or construction site.

Long-term air quality impacts associated with oil and gas activities are primarily dust related. Dust will be generated by construction work on roads, well pads, and pipelines. Since road, well pad, and pipeline construction is short-term, access road use is the only long-term source of fugitive dust. Road use has the potential to contribute a significant amount of dust for the life of the activity on native surface roads and to a lesser extent gravel roads during the dry seasons. The amount of dust will vary by soil type and moisture conditions. This impact can be largely mitigated by requiring dust abatement if the problem is judged significant.

Another potential source of particulates (PM10) is from the burning of slash cleared from roads, well pads, and pipelines. Because of air quality concerns, the disposal of construction slash by burning is no longer a common practice. Slash disposal is usually accomplished by scattering or burying. However, it may be permitted under weather conditions suitable for good dispersal of smoke.

PM10 from exhaust emissions from gasoline and diesel engines is not expected to be significant nor have any significant air quality impacts off site. The drilling phase of oil and gas activity has the most engines involved and the number of vehicles is minor. Onsite there will be some odor associated with exhaust emissions.

Lead (Pb): The activities associated with oil and gas exploration, production, and development do not typically produce lead emissions. Oil and gas activity would not likely have any effect on lead levels present in ambient air.

Effects to Class I Airsheds

No significant adverse impacts will occur to Class I airsheds located in the vicinity of the analysis area under any of the alternatives.

Visibility

Dust, because of it's size, is not a contributor to visibility-related problems (Colorado Air Quality Data Report, 1991). Since there are few sources of PM10 related to oil and gas activity, visibility would not likely be affected by oil and gas activity. If construction slash burning occurs it would be on days with weather conditions allowing for the dispersal of smoke. Visibility in Class I airsheds should not be affected by oil and gas activity.

Acid Precipitation/Lake Chemistry

Sources of sulfur dioxide are limited in oil and gas activity that could occur within the analysis area. Therefore, the activity would not likely contribute to acid precipitation and the potential acidification of lake water.

Cumulative Effects

Air quality impacts as a result of projected oil and gas activity would contribute a relatively minor addition to air quality degradation. Short-term and localized cumulative effects would occur in areas of concentrated management and recreational activity. The most noticeable effect would likely be a result of dust or would be in combination with burning, either prescribed or wildfire.

Environmental Factor: Water Quality

Oil and gas activities could adversely impact water resources, particularly water quality. The ground disturbance, which has been described in previous sections, has a high potential for increasing sediment delivery to stream channels. This could adversely impact the stability and hydrologic function of the channel. Activities could also impact beneficial uses of the water, both on Forest and downstream. Oil and gas operations generally use material and produce substances that can be harmful to the environment if not properly used and contained. The use of gasoline and diesel engines would require the use of large quantities of fuel that must be hauled to the site, and in some cases stored onsite. This always presents the possibility of spills, both large and small. In addition, use and maintenance of mechanized equipment would require the use of lubricants, that if not properly handled, could also contaminate water quality from surface runoff at construction sites. Drilling fluids contain toxic substances that could pollute the surface water and groundwater if not properly contained. Salt water is sometimes found in association with oil and gas bearing formations. This salt water could cause

contamination of high quality groundwater aquifers and surface waters, plus impact aquatic life and vegetation.

One of the important aspects of exploration activities is the waste water generated. Often produced water is strongly saline. The total dissolved solids (TDS) in produced water ranges from several hundred parts per million, to over 150,000 parts per million. However, the total dissolved solids in produced water from coal bed methane wells on and adjacent to the Forest has ranged from about 4,000 to 12,000 parts per million. Sea water, by comparison, is typically about 35,000 parts per million TDS. Produced water also contains trace quantities of petroleum hydrocarbons, metals, and additives used in the production process. The primary issue associated with the produced water is the potential for contamination of surface and groundwater, soil, vegetation, and animals. Oil and gas wastes from exploration, development and production activities include sediment, brine, drilling fluids, well bore cuttings and chemical additives related to the drilling and well completion process, hydrocarbons and sanitary wastes.

Another potential effect on water quality is increased sediment. Sediment transport is a natural stream process. The amount of sediment moved varies in direct response to streamflow. Each stream can transport a maximum amount of sediment without substantially adjusting its dimensions, slope or pattern; this maximum amount is called the sediment threshold. Sediment in excess of this limit is stored in the channel, is not easily displaced, and disrupts the dynamic equilibrium between the streamflow, the sediment load, and the channel. The channel may degrade (downcut), aggrade (build up) or migrate laterally around a deposit, resulting in accelerated bank erosion. Identifying what the theoretical sediment threshold for each stream is difficult and arguably very subjective. No sediment threshold limits have been identified in this analysis and given the minimal acreage to be disturbed and the mitigation that would be required, oil and gas activities would not be generating enough sediment to impact stream channels.

Sediment can also have a direct effect on aquatic life and habitat features. Excessive sediment beyond what the stream is capable of transporting can fill the voids in the gravel stream bottom. This reduces or eliminates the production of certain aquatic insects that are an important food base for fish. It also reduces the value of gravel beds for spawning habitat. Sediment may fill pools that are important resting and over wintering habitat for fish.

Alternative 1 - No Action

This alternative would result in a slight potential for adversely impacting water quality. Activities would be permitted in Floodplains, although *Controlled Surface Use* applies. Because of their close proximity to stream courses there is a higher risk that sediment or spill contaminants could be easily transported from activity areas to the stream.

Some development in Roadless Areas is expected, and with *Standard Lease Terms* applied, some increased sediment is likely to occur. Although the increases above natural levels would be so slight as to be of no significance.

Alternative 2 - Preferred

This alternative does the best job of combining water quality protection while permitting the greatest area for leasing availability. Areas of water quality sensitivity; Floodplains, Wetlands, Riparian, High Geologic Hazard and Slopes Greater than 60% are protected with a *No Surface Occupancy* stipulation.

Under this alternative the Kannah Creek Roadless Area (much of which is the primary water supply for Grand Junction) and Coal Creek (water Supply for Crested Butte) would not be available for lease. All or parts of nine of the nineteen Roadless Areas within the analysis area would not be available for surface disturbing activities. The Battlement Mesa Roadless Area would have *No Surface*

Occupancy. This is an area with a high potential for surface erosion. By not permitting surface development in the Battlements, potential impacts to water quality are reduced.

Alternative 3- No Lease

This alternative would result in no additional adverse impacts to water quality. There are situations where this would result in a lost opportunity to relocate or reconstruct an existing road for use by oil and gas activity, that is presently substandard and contributing to water quality degradation. The majority of forest roads are not surfaced and some local roads have inadequate drainage. Typically these would be the first deficiencies corrected if the road was to be used for oil and gas purposes.

Alternative 4 - Lease with Standard Lease Terms

This alternative would provide the least protection for water quality while making the greatest area available for leasing. No special protection would be provided in those environments which have been identified as being at the greatest risk or most sensitive in terms of contributing to water quality degradation. No special measures would be applied to protect domestic water supply areas. All Roadless Areas would be available for leasing under *Standard Lease Terms*.

Alternative 5 - No Lease in Roadless and SPNM

This alternative does the best job of protecting water quality, except for the no leasing option, but does not make as much area available for leasing as the preferred. The effects of this alternative in regard to water quality, are identical to Alternative 2, with the exception of its treatment of roadless and SPNM. The nineteen Roadless Areas considered in this analysis would not be available for lease. Roadless Areas make up approximately 1/3 of the total acreage within the analysis area. In addition to being roadless, many of these areas have high erosion hazard and a moderate to high potential for sediment production; they are steep; and contain areas of sensitive soils and High Geologic Hazard. Consequently these areas are generally among the most sensitive to water quality impacts within the study area. Predicting effects is made difficult because of the high level of uncertainty on exactly which lands will be acquired under lease and where on those leases activities will occur. Assuming in the future there is an equal chance of oil and gas activity occurring within the roadless component as there is in non-roadless, then a disproportionate amount of the impacts would accrue there. Once again it is significant to recognize that the RFD only projects a total of 75 acres of disturbance, and while there may be some theoretical differences among the alternatives in relative terms, those differences become insignificant.

Cumulative Effects

The RFD projects that activities will be heavily concentrated on the two exploratory units; Ragged Mountain - 10 wells and the Narrows - 10 wells. Although this suggests a fairly high density of activity, and disturbance and is certainly far greater than what is predicted to occur outside the existing units or leases, the total number of acres disturbed within the units is relatively small. One hundred seven (107) acres of the Narrows and Ragged Mountain Units would be disturbed. Disturbance would likely be spaced out over the 15 years in the planning period. This would mitigate some of the impacts to water quality. The units all lie within areas of moderate to high watershed sensitivity. This sensitivity is a function of the erosion potential, slope stability and topographic character of an area.

Based upon these considerations, there is a reasonably high risk that water quality would be modified, although the change should be slight and seasonal. The principal effect will be to increase sediment delivery to surface drainages. Sediment production would increase as a result of road and well pad construction. However, in most instances the contribution of management induced sediment will still be less than that contributed by natural sources and is not expected to jeopardize the classified beneficial uses of the water. In order to minimize additional sediment contribution to the extent feasible, Best Management Practices will need to be incorporated into the APD's. Those lands currently leased

do not have the environmental protection as that which will likely be made a part of future leases. Occasional spills of waste water and fuel are to be expected, although this should happen infrequently and remedial action would be prompt.

In addition to the effects of oil and gas activities are the effects that would occur as a result of planned timber harvest over the next decade. Timber harvesting is a connected effect because once a road is built into an area the economics of timber harvest often become more favorable. Road access could change the economic suitability of timber for harvest. However, before previously unsuited timber could be considered for harvest, the Forest Plan would have to be amended - a process that involves the public. This is particularly true with regard to several of the Roadless Areas, including but not limited to: Clear Fork, Springhouse Park, Priest Mountain, Electric Mountain and Salt Creek. The environmental sensitivity of many of these Roadless Areas is high. Should an area be roaded to one extent or another for oil and gas, it should be fully expected that timber sales will soon be considered within the area if suited timber if present. In many instances dual road use is a possibility and could help alleviate additive impacts. Each timber sale would require its own environmental analysis in which site specific effects will be examined and the status of oil and gas activities will be considered.

Environmental Factor: Water Quantity

The direct effects of oil and gas activities on water production from the unleased portion of the analysis area will be inconsequential. With the assumption that each well will impact 10.7 acres and the RFD only projects seven wells on new leases, the total area impacted is less than 80 acres. Project level watersheds are on the order of 10,000 acres, which means that even if all the projected activity was to occur within one watershed (which it won't), the total percent impacted would be less than 1%. Even considering the 40 wells predicted on existing leases and units, the water yield increase is not enough to be of any significance. This consequence is directly related to the vegetative alteration associated with road, well pad and pipeline construction (in areas dominated by mature trees).

It is not expected that oil and gas activities would have an effect on local water supplies. Some consumptive use of water is expected for drilling operations and possibly dust abatement. Whether the water is secured on the Forest or brought in from other sources, operators must comply with water use requirements of the Colorado Division of Water Resources.

Cumulative Effects

Water yield increases are judged to be a non-issue relative to oil and gas activities. However, when combined with potential timber sales temporary water yield increases would likely occur.

Environmental Factor: Groundwater

Alternative 1 - No Action
Alternative 2 - Preferred
Alternative 4 - Lease with Standard Lease Terms
Alternative 5 - No Lease in Roadless and SPNM

Shallow groundwater may be affected by the drilling and operation of the oil and gas wells, water source wells, water disposal wells, cathodic protection holes, geophysical shot holes and/or core test holes. Potential groundwater impacts from oil and gas activities could occur from migration of drilling fluids, poorer quality water and/or methane gas along the well bore to aquifers containing relatively higher quality water. During drilling, zones of varying pressure may be encountered. If problems arise in controlling the pressure, there would be a potential for interzonal migration of fluids from one zone to another. During production and abandonment, interzonal migration could occur due to corroded or poorly cemented well casings or improperly set cement plugs.

Groundwater effects related to coal bed methane wells include the potential disposal of the produced water and the potential contamination of groundwater by the seepage of released methane from the coal beds. Large quantities of water may be produced from a coal bed methane well for up to five years. Water may be disposed of in several ways, depending on its quality: surface discharge, direct use, surface evaporation pits and underground injection wells. Surface discharge must comply with Colorado Department of Health Water Quality Control Division, Colorado Discharge Permit System requirements. Water may or may not need special treatment before quality meets the required standard. Direct use is regulated under the Clean Water Act. Evaporation pits must meet specifications administered by the BLM, Colorado Oil and Gas Commission (COGC) and Colorado Department of Health. Underground injection wells must be permitted under the underground injection control (UIC) program of the COGC, and meet strict testing requirements to insure the water quality in the injection zone is less than the water being injected and special precautions have been taken to prevent interzonal migration of water.

Water disposal into deep wells would not likely cause adverse impacts on usable aquifers, due to the presence of thick interbeds of shale and the great depth differential. However, it is unclear how shallow disposal may affect usable aquifers. The effects may be site specific, varying depending on site characteristics. Based on experience in the vicinity of the analysis area, the quality of water produced is generally good (within State Clean Water quality standards). If so, the produced water would probably be discharged into evaporation ponds or surface waters. Depending on the volume of water produced, discharges into streams would have varying effects. High volumes of water discharged into streams may increase the potential for increased erosion.

Migration of methane along uncemented well bores have the potential to contaminate usable aquifers. Old wells in the vicinity of coal bed methane wells, which have inadequate cement, may provide an avenue for the upward migration of methane and the potential contamination of aquifers.

Oil and gas operators are regulated to protect fresh water zones with a total dissolved solids concentration of 10,000 milligrams/liter (mg/l) or less. (Primacy for the administration of water disposal or injection wells rests with the State of Colorado under an approved plan with EPA.) All these holes must be constructed to preclude the interzonal migration of fluids. In general, this is achieved by correct setting of casing, cement plugs, packers and/or other down hole devices. Occasionally, problems do arise which jeopardize or breach the integrity of a well bore. When problems are detected through monitoring, current regulations and onshore orders require prompt remedial work. Consequently, there is only a low potential for any impacts to the groundwater resource. If any impacts should occur, their significance would be minimal.

Construction of access roads and gas pipelines or gathering lines may have an impact on groundwater. Often times this construction occurs in the same right-of-way. The potential impact is low since the construction would not directly penetrate groundwater aquifers. Potential short term impacts that could occur include surface spills of fuels and other fluids used during construction activities. The magnitude and duration of these impacts would most likely be minimal since spills would be small, localized and remedial actions quickly initiated.

The potential impacts to groundwater from the use of access roads consist of spills and/or leaks from tank trucks hauling fuels and other fluids used in the equipment or hauling produced water for disposal. The magnitude and duration of any of these impacting groundwater is low, since any spill or leak would be localized and contained. Any major spill or leak must be immediately reported to the Forest Service and BLM and remedial action taken to lower potential impacts. Because of the controls required for reporting and cleaning up of any spills or leaks, potential impacts to groundwater are expected to be minimal.

There could be a moderately greater risk to potable water in the municipal watershed areas. This is especially true in the Wiley Spring (Crawford), Bell Springs (Paonia) and West Terror Springs (Pitkin Mesa) areas where the springs, which are considered part of the shallow groundwater system for the

purpose of this analysis, are the primary source of supply. Under these alternatives, the watersheds of special interest to municipalities would be open to surface occupancy. If impacts occurred from failures of casing or plugs, there could be adverse impacts to water quality.

Alternative 3 - No Lease

Under this alternative, the effects would be similar to those described above, but they would be limited to existing leases, only.

Cumulative Effects

Oil and gas operations are currently operating within the study area. These operations have not adversely impacted the groundwater quality or groundwater levels. If the required stipulations, regulations, standard engineering practices and appropriate mitigation measures are followed, additional oil and gas development activities should not result in long term cumulative impacts to groundwaters.

Environmental Factor: Range

See the discussion under Primary Rangelands on page IV-84 of this chapter.

Environmental Factor: Roads

Road Construction/Reconstruction

Because the majority of oil and gas activity is predicted on existing leases, there is only a very slight difference in the effects that would occur to the transportation systems for each alternative described in this analysis.

Alternatives 1, 2, 4, & 5 would all have the same effects with providing access to the seven wells predicted on new leases, whereas alternative 3 would not require any additional access.

Even though alternatives 1, 2, 4, & 5 show the same number of miles, there are differences that need to be addressed. Below is a brief summary of potential for new road construction, by alternative. All alternatives share the same requirement that access be allowed to existing leases. The oil and gas operator would bear the cost of all required road construction/reconstruction.

Alternative 1 - No Action

This alternative would allow for roads to be constructed within all of the Roadless Areas, Research Natural Areas, Sensitive Areas, Retention VQO areas, Semi-primitive Non-motorized areas, Recreation Complexes, Watersheds of Special Interest to Municipalities, and wildlife areas.

Alternative 2 - Preferred

The difference between this alternative and Alternative 1 is that specific Roadless Areas such as Battlement Mesa, Kannah Creek, Roubideau, Tabeguache, Whetstone Mountain, Flat Top Mountain and parts of West Elk, Raggeds and Priest Mountain would not be subject to new road construction under either *No Lease* or *No Surface Occupancy*. (This does not apply to existing leases). All other Roadless Areas would be subject to new road construction. Also under this alternative, Research Natural Areas and Sensitive Areas would not have any new roads constructed on them. (Again with exception to existing lease areas.)

Alternative 3 - No Lease

Under this alternative, all new road construction would be limited to providing access to areas with existing leases.

Alternative 4 - Lease with Standard Lease Terms

This alternative would allow for new road construction in all areas of the Forest, with exception of Wilderness. Control of the roads would be provided by the *Standard Lease Terms*.

Alternative 5 - No Lease in Roadless and SPNM

This alternative differs from Alternative 2, by not allowing any new road construction in the Roadless Areas and SPNM areas.

Cumulative Effects

The table below shows the miles of road construction and reconstruction. The road miles are broken down into existing units, existing leases, new leases and proposed timber sales. The amount of new road construction needed for oil and gas operations on the Forest is minimal and would not add significantly to the cumulative effects of roads within or adjacent to the analysis area. New roads on the Forest generally will be closed to public travel, lessening the impacts to wildlife, wildlife habitats and recreational use. Further analysis of the cumulative effects of roads will be done at the time the NEPA work for the SUPO is done.

TABLE IV-3. MILES OF NEW ROAD CONSTRUCTION

	AREA	ALT. 1	ALT. 2	ALT. 3	ALT. 4	ALT. 5
UNITS	Narrows	10	10	10	10	10
	Ragged Mtn	10	10	10	10	10
EXISTING LEASES	Petro Leases	2	2	2	2	2
	Other Leases	18	18	18	18	18
NEW LEASES	Total Analysis Area	7	7	0	7	7
TIMBER SALES*	Entire Forest	240	240	240	240	240
TOTAL		287	287	280	287	287

* Sales identified in the Forest Plan for the next decade, for the entire Forest.

The miles of road reconstruction would be the same as the miles of new road construction.

Cumulative effects of roads are also discussed under other *Affected Environments* in this chapter, i.e. General Forest, Wildlife Special Habitats.

Road Use

For each well drilled in the analysis area, there would be an increase of approximately 13 vehicles per day, during the exploratory drilling period. The exploratory drilling will normally go on for about 60 days. During production, the increase in traffic would only be about one vehicle per day.

The road with the largest expected increase in use would be the Buzzard Divide Road FDR 265. It is estimated that this road would provide access for approximately 20 wells. This would result in an estimated peak traffic increase of approximately 13 vehicles per day over the 15 year period.

The roads listed would be accessing wells in existing units and leases and would therefore have the same impacts on all alternatives.

Under all alternatives, some impact would occur to the State Highways that provide access to the analysis area. Highway 133 (McClure Pass), 65 (over Grand Mesa) and 330 (Collbran) are the highways that would be most likely to experience an impact as a result of oil and gas activity. The increase in traffic would be relatively minor and in all cases, short-term. In addition to the 13 or so vehicles per day estimated to occur daily for the two months during drilling, a pulse of heavy truck traffic would occur just before and after drilling. Heavy trucks would generally make two loaded trips over the highway - to and from the drill site. The truck traffic may cause some disruption of the normal flow of traffic on State Highways, especially when traversing steep grades.

A permit will be required from the State to build any access road directly from a State Highway.

Road Maintenance

Prior to commercial use of Forest Development Roads, the operator must have a road use permit. This permit has specific requirements for any work to be done on roads they would be using, including any maintenance requirements.

This permit would require the operator to do maintenance work commensurate with their share of road use.

Included in the maintenance requirements is a schedule for surface rock replacement. From prior analysis and studies on the Forest, it has been determined that the associated traffic from four wells would result in one inch of gravel loss from the road surface.

Roads such as the Buzzard Divide road would need to be resurfaced one to two times over the 15 year period. The biggest impacted area would be the Buzzard Divide area, as described above in road use. There are no known aggregate sources on the Forest in this area. All gravel would be hauled in from private sources.

Road maintenance costs are shared based on traffic volume of each user. For example, if the oil and gas operations amount to 50% of the traffic, then their share would be 50% of the road maintenance cost.

Environmental Factor: Visual Resources

The oil and gas development activities that are most likely to have a significant visual impact are those that take place during exploratory drilling, field development and production. Activity associated with exploratory drilling is likely to cause the most significant change to the visual resource. Activities in the development and production stage may be less intrusive, but typically are longer lasting.

During exploration, a road and well pad are typically constructed to accommodate the drilling rig. An oil derrick on a drilling rig typically may be as high as 150 feet. The drill rig and site is lighted at

night for safety and around the clock work. On average, a well rig can be expected to be in place and operating 30 to 60 days. This would be a short term visual impact.

Once the exploratory drilling is completed, the drill rig and the oil derrick are removed. If oil and gas resources are found, some permanent facility would be required at the site. If oil and/or gas from the well does not flow naturally, a pumping unit may be required. These pumping units are generally twelve to fourteen feet high. If the well flows naturally, a unit described as a "Christmas tree" would be used to regulate the flow of oil and gas to the surface. The Christmas tree unit can range from four to eight feet high. The potential for visual impacts are minimized with the use of Christmas trees rather than the pumping units. These facilities would not, in most cases be a significant visual impact.

Other permanent facilities at the well site include the treater and/or separator tanks, storage tanks, tool shed, generators and pipe racks. The separator tanks have a vertical orientation and can be as high as twenty feet. Storage tanks are typically fifteen feet high. Tool shed, generators and pipe racks vary between eight and twelve feet high.

Any new roads or upgrading of existing roads can also have a visual impact. Roads on steep slopes would result in cut slopes that could potentially be seen from long distance. Transmission pipelines can also have a visual impact, creating linear opening in vegetation which can be seen from long distance.

Oil and gas exploration activities in adopted Partial Retention VQO areas, particularly if they are viewed in foreground or near-middle ground (1/4 to 3 miles from the viewer) situations, are the areas most likely not to meet its VQO. The structures necessary for the exploration activity would appear to dominate the landscape. Generally beyond 3-5 miles the visual impacts can be mitigated. Site specific effects on the visual resources will be determined at the project proposal stage, possibly with the use of computer generated perspective plots.

Of the seven wells within the RFD scenario, the four on the Grand Mesa National Forest are most likely not to meet their adopted VQO. This is because of the number of proposed new wells and its high concentration of Retention VQO, Scenic Byway Corridors, and other viewer platforms.

Alternative 1 - No Action

This alternative includes *No Surface Occupancy* for Retention VQO - Low VAC areas and *Controlled Surface Use* for Retention VQO areas. With these stipulations the adopted VQO's for the analysis area would generally be met except for potential minor impacts within Scenic Byway Corridors.

The overall effects on scenery within the analysis area would be more than Alternative 2, however it would still be minimal. This alternative would result in the area generally retaining its natural characteristics.

Alternative 2 - Preferred

This alternative includes *No Surface Occupancy* for Retention VQO - Low VAC areas and *Controlled Surface Use* for Retention VQO areas and Scenic Byway Corridors. With these stipulations the adopted VQO's for the analysis area would generally be met.

The overall effects on scenery within the analysis area would be minimal. This alternative would result in the area generally retaining its natural characteristics.

Alternative 3 - No Lease

This alternative would result in no additional leasing for oil and gas within the analysis area. This alternative would have no environmental consequences on the visual resource (scenery). This alternative would maintain most of the visual resource in its existing visual condition.

Alternative 4 - Lease with Standard Lease Terms

This alternative would have the most potential for impact to the visual resource of any of the alternatives. It allows the entire analysis area to be leased using *Standard Lease Terms*. With this stipulation the adopted VQO's for 19% of the analysis area may be adversely impacted.

This alternative could result in much of the area changing from what is now a natural appearing visual condition to one that is heavily modified during the exploration phase. The activity described under the RFD could feasibly occur anywhere within the analysis area. The adopted VQO's would not be met in Retention and Partial Retention areas during the exploration phase.

Alternative 5 - No Lease in Roadless and SPNM

This alternative is the second best alternative for maintaining visual resources (scenery). Only alternative 3, is better. This alternative would not allow new leases in Roadless Areas or 3A management areas (Semi-primitive Non-motorized). It's treatment of Retention VQO - Low VAC areas, Retention VQO areas, and Scenic Byway corridors is the same as Alternative 2 and the effects in those areas would be the same as described in Alternative 2.

Cumulative Effects

Most of the existing leases, where the majority of the oil and gas exploration and development is projected, are not in Retention or Partial Retention VQO areas. The remaining area covered in this leasing analysis has experienced a low level of oil and gas exploration and development. The RFD only predicts seven exploration wells will be drilled on new leases. Because of the absence of wells in Retention and Partial Retention VQO areas and the low number of wells being projected, the anticipated cumulative effects of this leasing decision on the visual resource at both the exploration and production stages would likely be minimal.

Environmental Factor: Recreation Opportunities

Analysis of the impacts of oil and gas development on the recreation resources is based on typical historical and projected oil and gas activity at the well site, on new pipelines and on new roads. Changes in recreation opportunity and use are described for each alternative. This description includes a discussion on Developed Recreation Complexes, Dispersed Recreation Complexes, Major Trail System complexes, and 3A Management (SPNM) areas.

The oil and gas development activities that are most likely to have a significant impact are those that would take place during exploratory drilling, field development and production. Drilling is likely to cause the most significant change to the recreation resource. Activities in the development and production (operation and maintenance) stage may be less intrusive, but typically last longer.

During exploration, a road and well pad are typically constructed to accommodate the drilling rig. Until the well pad is completed and the drilling rig removed, there would be some traffic to and from the site. The average traffic to the well pad is estimated to be thirteen vehicles per day. This traffic would increase the dust on and near roads in the vicinity of the drill site. Drilling requires many support activities and once started, it usually continues seven days a week, 24 hours a day. During this time period large diesel engine are used which may be heard up to a mile from the drill site. On average, a well rig can be expected to be in place and operating 30 to 60 days. These activities, are short term but could potentially conflict with recreational use, resulting in a reduced recreational experience, a change in the physical setting of the area, and ultimately reduced use.

Once the drilling is completed the well rig and the oil derrick are removed. If oil and gas resources are found, some permanent facility would be required at the site. Traffic associated with routine

maintenance of the production facilities may conflict with some types of recreational use (sightseeing, auto touring, hunting, etc.)

Any new roads or upgrading of existing roads can also have a recreation impact. Roads on steep slopes may require cut slopes that can be seen from far distances. Transmission pipelines can also have a impact, creating linear openings in vegetation which can be seen from far distances.

Alternative 1 - No Action

This alternative would include *Controlled Surface Use* for the Recreation Complexes and the 3A areas. While this would protect the developed recreation facilities, some visual and audio impacts may occur to their settings which may result in a reduction of the visitors recreation experience and or use.

The overall effects on recreation within the analysis area would be more than Alternative 2 and could be significant. Opportunities for dispersed backcountry recreation such as hunting may be reduced. Of the seven wells within the RFD scenario, the four on the Grand Mesa are most likely to impact the developed recreation setting quality. This is because of the number of proposed new wells and the high concentration of recreation development and use.

Alternative 2 - Preferred

This alternative would result in *No Surface Occupancy* in Recreation Complexes and 3A management areas. This would protect most of the developed recreation facilities in the analysis area. Facilities at a few concentrated use sites such as Antone Springs Campground, Iron Springs camp area, and Trickle Park camp area could be impacted. Some dispersed hunting areas may become roaded and reduce the quality of the current hunting experience for some hunters.

The overall effects on recreation within the analysis area would be minimal. This alternative would generally retain the natural character of the high density use areas (Developed Recreation Complexes) and the sensitive recreation environmental areas (Dispersed Recreation Complexes, Major Trail System Complexes and 3A Management - SPNM areas). Opportunities for dispersed backcountry recreation such as hunting may be reduced.

Alternative 3 - No Lease

This alternative would result in no additional leasing for oil and gas within the analysis area. This alternative would have no environmental consequences on the recreation resource. This alternative would maintain the recreation resource in its existing setting.

Alternative 4 - Lease with Standard Lease Terms

This alternative would potentially impact the recreation resource the most of any of the alternatives. It allows the entire analysis area to be leased with *Standard Lease Terms*. With *Standard Lease Terms* the recreation resource could be significantly impacted. Opportunities for dispersed backcountry recreation such as hunting may be reduced.

This alternative could result in much of the area changing from what is now a natural appearing setting to one that is heavily modified during the exploration phase. This would potentially affect the quality of recreation and may result in relocation of use or a loss in use. The activity described under the RFD could feasibly occur anywhere within the analysis area.

Alternative 5 - No Lease in Roadless and SPNM

This alternative is second only to Alternative 3 in the protection of recreation resources. It includes no leases in Roadless Areas and 3A Management Areas (Semi-primitive Non-motorized ROS); and *No*

Surface Occupancy in Recreation Complexes. Opportunities for dispersed backcountry recreation would be maintained. Effects outside roadless would be similar to Alternative 2.

Cumulative Effects

Historically, most of the existing leases, where the majority of the oil and gas exploration and development is proposed, are not within or adjacent to the Recreation Complexes or 3A management areas. The remaining area covered in this leasing analysis has experienced a low level of oil and gas exploration and development. The RFD only predicts seven exploration wells will be drilled. Because of the absence of wells in these areas and the low number of wells being proposed in these areas, the anticipated cumulative effects of this leasing decision on the recreation resource at both the exploration and production stages would be minimal.

However, a significant portion of the Forests dispersed recreation use such as hunting does occur within and around existing leases. The anticipated cumulative effects of this leasing decision on the recreation resource at both the exploration and production stages could be significant.

Environmental Factor: Cultural and Historical Resources

Most of the historic, architectural and archaeological values of cultural sites can be protected effectively through application of the National Historic Preservation Act (NHPA) of 1966 as amended and the Archaeological Resources Protection Act (ARPA) of 1979 as amended in the event of oil and gas activity. However, the NHPA may not protect all historic values associated with a cultural property, especially if the property has more than scientific worth. Cultural sites may contain educational and recreational values that are not protected by NHPA or ARPA; these values are the ones most endangered by oil and gas activity as they are not protected by law or the current Forest Plan. *Standard Lease Terms* may not be sufficient to protect these resources with recreational, educational, and interpretive values because of the linear extent of these resources.

Traditional landscapes important to American Indian cultures would potentially be impacted by oil and gas activity. These are areas that may include geologic features, watersheds, habitat, plant areas or combinations of these features that are valued by aboriginal people because they are sacred. Such areas are used for religious, spiritual, and/or cultural purposes; they have ancestral significance to American Indian peoples. These areas are not currently protected by law.

Cumulative Effects

Oil and gas activity combined with planned and potential timber harvest may result in degradation of these resources or of the sensory environment associated with these resources, or create conflicts with recreation and traditional user of these resources and areas.

Environmental Factor: Wildlife

The potential effects of oil and gas development on wildlife in wildland environments can be both numerous and varied in their intensity. The severity of the effect is site-specific and depends on such factors as: (a) the sensitivity of the species affected; (b) the type of disruption; (c) the characteristics and importance of the affected habitat and; (d) the availability and condition of alternate habitat (Bromley, 1985).

Oil and gas activities will adversely impact some wildlife species or their habitat wherever they occur. Ungulates, carnivores, and raptors may be more affected because of their sensitivity to disturbance. While small birds and mammals may be affected in large numbers locally, they are more capable of rapid recovery because of their higher reproductive rate and wide distribution. Response to disturbances varies among species and even individuals depending on the type, duration, and severity of the disturbance. These effects may be most critical (a) during times when the animals are already

stressed by natural conditions, (b) in habitats traditionally used by populations during critical periods of their life cycles, (c) for species whose social organization or behavior makes them susceptible to disturbance, and (d) for certain sex or age groups of animals (Bromley, 1985). This is either a permanent or temporary effect depending on the type of activity. A well pad in essential habitat is a permanent effect for the plant or animal species involved. A seismic blasting operation may be a temporary effect on a species because the activity would result in only a temporary displacement of the animal into an adjacent area until the disturbances have subsided.

Alternative 1- No Action

Under this alternative, current Forest Plan direction would be used to identify special stipulations related to wildlife habitats within the general forest *Affected Environment*. Only general direction is provided, concerning road construction and use as it affects Management Indicator Species and Big Game Winter Range. This direction may be grossly interpreted as *Controlled Surface Use* or *Timing Limitations* stipulations on a few areas and activities. Specific *Timing Limitations* are identified for bighorn sheep lambing areas and select raptor species nesting sites (see Appendix H). The lack of specific direction would likely result in *Standard Lease Terms* being applied to wildlife habitats. All Roadless Areas, which are important refuges for many wildlife species, would be open for oil and gas activity. This could be detrimental to those wildlife species that are dependent upon security habitat and inaccessibility from humans. The effects would be as described under *Standard Lease Terms*, on pages IV-8 to IV-12.

Alternative 2 - Preferred

Under this alternative, wildlife would be afforded more protection than those in Alternative 1, because *Controlled Surface Use* stipulations would be applied in addition to *Timing Limitations* in Big Game Winter Range, deer and elk birthing areas, and Migration Routes and Stating Areas.

Rocky Mountain and desert bighorn lambing and breeding ranges and Sage Grouse Leks would have *No Surface Occupancy* stipulations applied which would protect these traditionally used sites. Wildlife within the Battlement Mesa, Kebler Pass Corridor, Whetstone Mountain, Flat Top Mountain, Kannah Creek, Roubideau, Tabeguache and parts of the Priest Mountain Roadless Areas would be protected from the potential effects of oil and gas activity because these areas would not be leased or would have the *No Surface Occupancy* stipulation applied.

Other resource concerns within Roadless Areas will effectively protect wildlife resource values, i.e. *NSO* for Concentrated Use Summer Range.

Alternative 3 - No Lease

This alternative would result in no additional adverse impacts to wildlife or their habitat. While only seven new wells are expected to occur on new leases, it would still be a lower level of impact to wildlife than would be expected to occur on the existing leases plus any new lease areas. This alternative would be be most favorable from a wildlife standpoint.

Alternative 4 - Lease with Standard Lease Terms

Under this alternative, "reasonable measures", as provided by *Standard Lease Terms* and the Forest Plan standards and guidelines would result in this alternative having the same effects as Alternative 1 - No Action. It does not provide protection above and beyond the Forest Plan to bighorn sheep breeding areas, Sage Grouse Leks, or critical habitats of species other than Management Indicator Species. Roading would likely result in additional human activity such as timber harvest, recreational activities, trapping, and poaching.

Alternative 5 - No Lease in Roadless and SPNM

This alternative is the same as Alternative 2 for wildlife special environments. *Timing Limitations* and *Controlled Surface Use* stipulations would be applied to Big Game Winter Range, deer and elk birthing areas, and Migration Routes and Stating Areas. Sage Grouse Leks and bighorn sheep lambing and breeding areas would have *No Surface Occupancy*.

The major and extremely significant difference for wildlife with this alternative is the protection of wildlife habitat in all Roadless Areas. This would be extremely beneficial to all wildlife and their habitat that occur in Roadless Areas. Without any oil and gas development, and its necessary road access, these areas would not be subject to increased human encroachment. Timber harvest, recreational development, poaching, and trapping would not be additional impacts to native wildlife populations and their habitat. These areas would remain as refuges for species requiring large home ranges, large expanses of secure habitat, and those species intolerant of humans and their activities. This alternative would be beneficial to threatened and endangered species, as these areas would remain potential re-introduction sites.

This alternative would be the most desirable from a wildlife standpoint, after Alternative 3 - No Lease.

Cumulative Effects

The cumulative effect of oil and gas leasing and development, combined with potential connected actions and planned projects in the analysis area, may be significantly greater than the effect of oil and gas activities considered alone. Forty-seven (47) oil and gas wells are projected to be drilled in the analysis area in the next 15 years. Seven new wells are expected to be drilled on new leases. The remaining 40 wells projected under the Reasonably Foreseeable Development (RFD) scenario, will be drilled on existing leases and units. Thirty-eight (38) of these wells are planned on the Grand Mesa and Gunnison National Forests, within close proximity of each other. Much of this predicted activity could occur in Roadless Areas and could have adverse effects on wildlife and their habitats (See discussion below).

Drilling for oil and gas creates wildlife impacts that can be separated into two functions: 1) the activity itself and; 2) the subsequent increase in access (Stubbs, 1979).

Drilling activity results in an increase in the number of new roads constructed into an area. This could dramatically increase the amount of both legal and illegal hunting. This would result in a overall reduction in ungulate wildlife numbers and other species that are trapped or hunted. Dramatic undesirable changes in big game animal sex ratios may also occur. The male segments of the populations could be drastically reduced because of the increased hunting pressure associated with increased access. Bull elk and buck deer would become more vulnerable. Direct mortality due to roads is always a possibility, because of vehicle/animal collisions and poaching of game that always occurs where roads are present.

The cumulative effects on wildlife, including threatened and endangered species, of oil and gas leasing, connected actions, adjacent or succeeding actions such as timber sales, recreational developments, subdivision and land development is largely unknown at this time. The connected action of timber harvest in previously unroaded habitat would be especially detrimental for many wildlife species, particularly big game and furbearers and other species requiring large home ranges, secure habitat, and/or strict cover requirements. One activity considered alone may cause a temporary displacement of an animal species, but when several activities are occurring simultaneously in adjacent drainages, permanent displacement or outright elimination of the population could occur because of a lack of essential habitat.

If Roadless Areas are entered with oil and gas activities, the roads would provide access to suitable timber stands, including old growth, that were previously uneconomical because of high road costs. (Environmental analysis and a Forest Plan amendment would be required before such stands could be managed for timber production.) This could have a very negative effect on the variety and density of wildlife species which use these areas as security habitat or as the only habitat where they can survive. Some of the species which are dependent upon these areas for all or most of their habitat requirements include the lynx, wolverine, pine marten, goshawk, black bear, mountain lion, red crossbill, hairy woodpecker, Lewis' woodpecker, and Mexican spotted owl. The most detrimental effect on the goshawk and its habitat could come from timber harvest along roads constructed for the oil and gas activities. Clearcutting of aspen stands converts goshawk habitat into habitat well suited to the red-tailed hawk, which is not experiencing population declines. Timber harvest in previously inaccessible mature ponderosa pine stands would be very detrimental to the future existence of the Abert's squirrel, which is already declining in numbers. The red crossbill has a fairly large home range over thick coniferous forests and would be more impacted by the possible connected action of timber sale activity over its habitat than actual oil and gas exploration and development. However, potential timber harvest as a connected action would have a more far-reaching effect on woodpecker populations (primary cavity nesters) and a large group of other birds and small mammals that nest or den in the cavity excavations of the woodpecker family. These cavity excavators rely on large mature or old growth ponderosa pine, Douglas fir, aspen, lodgepole pine, Engleman spruce, and subalpine fir trees for their nesting habitat. In addition, species such as the elk, bighorn sheep, mountain goat, mule deer, and wild turkey use these areas for a portion of their life cycle to find solitude or escape from hunters. Roads would result in reduced security cover and increased access by hunters, making all wildlife species more vulnerable to hunters or poachers. Roads and associated timber harvest would cause forest fragmentation, resulting in the disappearance of wildlife species requiring large home ranges in natural communities.

Furbearers are especially vulnerable to trapping in previously unroaded habitats. Many furbearers such as the lynx, wolverine, pine marten, bobcat, coyote, fox and mink would become more vulnerable to local extirpation and extinction as evidenced by the eradication of these and other species in the Rocky Mountains as development occurs. Roads would provide access routes to trappers who could easily "trap out" small remaining localized populations of lynx, wolverine, and pine marten. Mitigation would involve strictly controlling public access by closing the roads to all motorized vehicles during operations and the physical permanent closure or obliteration of the roads after the operations are complete.

The combined effect of all these activities would be much more impactive on wildlife species than just the planned activity of oil and gas development.

Environmental Factor: Wildfire

Potential for wildfire would be similar under all alternatives. Oil and gas activity which could result in wildfire would be the similar under all alternatives. Alternative 3, the No Lease Alternative would result in a slightly smaller chance for wildfire because it would build fewer roads. Improved access provided by oil and gas activity would result in a higher potential for man caused fire, but it could also provide for more efficient suppression of wildfire.

Cumulative Effects

The level of projected oil and gas activity and associated ground disturbance is such that no significant cumulative effect to fuel loading and the potential for wildfire would occur. The potential for subsequent timber harvest to occur in areas roaded for oil and gas would provide additional roads which could be available for future fire suppression activities.

Environmental Factor: Social and Economic Conditions

Impacts from oil and gas development could affect social and economic conditions in Mesa, Gunnison, Delta, Montrose, Ouray, San Miguel, Hinsdale, and Saguache counties in south western Colorado. Drilling in the analysis area would occur in Delta, Gunnison, Mesa, Montrose, and San Miguel counties, according to the Reasonably Foreseeable Development scenario projected for the Forest. The three remaining counties (i.e., Ouray, Hinsdale, and Saguache) are considered to be within the Forest social and economic zone of influence.

The magnitude of the impacts on social and economic conditions would depend on the number of drilling operations, number of production wells, and the distribution of drilling activity at one time. Under the Reasonably Foreseeable Development scenario for each alternative 40 wells will be drilled in the next 15 years on existing leases, or less than 3 wells, annually. In addition under each lease alternative, an additional seven wells will be drilled in the next 15 years on new leases, or a well every other year. The RFD estimates 28 of the 40 existing-lease wells will be completed for production, while 3 of the seven new-lease wells will be completed for production.

While an average of .5 wells per year would be drilled on new leases, drilling activity will likely fluctuate above or below the average from year to year. Over the last thirty years a maximum of 5 wells have been drilled on the Forest in a single year. Total future average drilling activity on the Forest is predicted to be significantly larger (3.1 wells annually) than past drilling activity (1.4 wells annually from 1986-1990 and .8 wells annually from 1958-1990). Drilling on new leases will be a small (15%) part of total drilling activity on the Forest.

Federal, State & Local Mineral Receipts

The estimation of Federal, State, and local mineral receipts from oil and gas leasing is a complex and difficult task. Many different laws, regulations, jurisdictions and formulas are involved. The following information describes the rentals, royalties and taxes resulting from a single production well on the Forest.

Rentals

The lessee is required to pay rental fees for the use of Federal land for oil and gas activities. Failure to pay the rental fee will invalidate the lease. Rental rates have varied over the years, but the current rates are $1.50 per acre per year, for the first five years, and $2.00 per acre per year after that. The Forest currently has approximately 250,000 acres under lease for oil and gas. Assuming an average of $1.50 per acre per year for oil and gas lease rental fees, the return to the Federal treasury is about $375,000 per year. The fees are required even if there is no oil and gas activity on the leasehold.

Royalties

Federal royalties are 12.5% (one eighth) of the value of oil and gas from Federal oil and gas leases. Payments to the State are one half of Federal royalties. In addition, Colorado imposes a progressive severance tax on oil and gas production. Drilling equipment, pipeline and oil and gas produced are all taxed by the counties they are located in as personal property.

Oil is currently selling at around $20.00 per barrel and gas $1.50 per thousand cubic feet (MCF). The most recently drilled well on the Forest is Petro-Energy's 1-26 well on the Paonia Ranger District which produced 237,250 MCF of gas in its first year and is expected to decline in production at an 8% rate. Using the Petro-Energy well as an example, the 1990 gross value of gas produced from the 1-26 well was $355,875. The Federal royalty is $44,484 of which half ($22,242) goes to the State of Colorado.

State of Colorado Severance Tax

The State of Colorado imposes a progressive severance tax on the gross value of oil and gas production. The severance tax is as follows:

* 2% of the first $25,000 gross value

* $500 plus 3% of the gross value over $25,000 and less than $100,000

* $2,750 plus 4% of the gross value over $100,000 and less than $300,000

* $10,750 plus 5% of the gross value over $300,000 (Colorado Department of Revenue)

The State of Colorado severance tax for the Petro-Energy well would be $13,543.75 for 1990.

County Personal Property Drilling Rig Tax

Drilling rigs used on the Forest generally have a capability of drilling 8,000 feet and are valued at $101,120 according to standard State of Colorado valuation tables. Such a rig is taxed on 29% of its value at an average mill levy of .065 or $1,980 for a full year or $5.42 per day. The actual tax is based the number of days a drilling rig resides in a particular county. The average well takes approximately 60 days to drill and would be taxed at the County level an average of $325.20 per hole drilled.

County Value Added Tax

Gas and oil production is also taxed by counties on a mill levy based on seven eighths of gross value (gross value minus Federal royalty). As mentioned above the average mill levy is .065. County property tax on the first year's production of $355,875 would be $20,240.39.

County Personal Property Pipeline Tax

The pipeline which takes the oil and gas to market is also taxed based on 97% of the cost of putting in the pipeline and allowing for 3% depreciation annually thereafter. Assuming pipeline costs average $100,000 per mile to lay and 2.5 miles of pipeline are needed to tap into the nearest trunk line. The total value of the pipeline is $250,000 and the first year County tax would be $15,762.5. An additional complication is that the Federal Government gives a tax credit from Federal royalty payments for pipeline construction. Therefore, the first year of production would occur without having to pay full Federal royalties. Actual royalties would be $13,234.38 [($355,875 - $250,000)*12.5%] of which $6,617.19 goes to Colorado.

In summary the gross value of Petro-Energy well's first year of production is estimated to be $355,875. The allocation of the first year receipts would be as follows:

* $13,234.38 in Federal royalties of which $6,617.19 goes to Colorado (3.7%)

* $11,319.53 in Colorado severance tax (3.2%)

* $20,240.39 in value added tax to the resident County (5.7%)

* $16,087.70 in personal property drilling rig and pipeline tax to the resident County (4.5)

* $294,993.00 (83%) to the owner to cover the cost of drilling and maintaining the well, corporate income taxes, and profit.

There are some additional taxes to be paid, but the majority of taxes are explained above.

Assuming the Petro-Energy well is an average well, taxes and royalties from new leases could provide $4,000 to the State of Colorado and $8,000 to local counties assuming the average rate of .5 wells per year and a success ratio of three-out-of-seven wells drilled. Assuming all seven wells are drilled in a single year and the same three-out-of-seven success ratio, the taxes and royalties would be $55,000 and $110,000 respectively. Likewise, taxes and royalties from existing leases would be $35,000 and $70,000 the first year assuming an average rate of drilling and a 28-out-of-40 success ratio. If all 40 wells were drilled in a single year taxes and royalties would be $500,000 and $1,020,000.

Due to the location of County boundaries and likely well sites, Delta County would likely provide a majority of services, while Gunnison and Mesa Counties will receive most of the tax receipts distributed to counties. Delta County is the most likely access route to a majority of well sites requiring additional road maintenance funds. Delta County has the closest and most logical access to police, fire, lodging, medical and other services. Few well sites would actually be located in Delta County. Delta County may experience more costs from oil and gas operations than it receives in oil and gas royalties and taxes.

Population, Employment, and Personal Earnings (Income)

None of the alternatives would cause major changes from current conditions in population, employment, and personal earnings for the local and regional zones of influence. Under the Reasonably Foreseeable Development scenario, it is assumed that there would be no critical boom-bust cycle that would cause major demographic changes. The population would generally continue at current levels, although there may be some short-term fluctuations related to drilling activity over the 15-year period.

A typical drilling crew of 10 workers can drill a well in about 60 days with expenditures of approximately $1 million for equipment, goods, and services related to drilling activities. The expenditures would occur in the economies of the local and regional zones of influence, as well as larger, nationwide trade areas. A drilling crew can drill approximately 4 wells a year, which would require 10 workers. If all seven wells on new leases were drilled in a single year, 20 drilling workers would be needed, but not for the entire year. In Delta County alone, the 1991 average employment was 7,700 people, and the average number of unemployed people was 800 (Colorado Labor Force Review - Data Supplement - 1992, page 46). The addition of 20 jobs would not significantly affect employment in Delta County or the Forest influence zone as a whole even if all 20 jobs were filled by local workers. This is unlikely as drilling crews usually come from outside the area with the drilling rig.

On an average annual basis, drilling seven wells over a 15-year period in the study area would provide fewer than 10 part-time jobs annually. A single 10 person drilling crew could drill 4 wells annually over the next 15 years. Current levels of employment and income would not significantly change during the next 15 years due to drilling seven additional wells on new leases or the 40 wells on existing leases.

Social Conditions

There would not be significant changes from current social conditions under any of the alternatives. The number of new people in the area (less than 20) would not affect local social conditions.

As described above in the section on population, it is not anticipated that there would be any major long-term changes in population as a result of the projected oil and gas activity. Factors that affect lifestyles, attitudes, beliefs, values, social organization, and settlement patterns would therefore not likely change from current conditions. Demand for housing, schools, water, sewage systems, law enforcement, emergency facilities, and recreation would not increase significantly.

Counties and communities in the local and regional zones of influence have prior experience with oil and gas exploration and development.

Existing farm families, small-town residents, and local business people, would experience few changes to their daily lives as a result of the projected oil and gas activity in the study area. Oil and gas operations have been ongoing in the area for at least 30 years and have become a periodic factor in the community. Traditional values and uses of the land and resources, such as preservation of family farm, ranch, and business operations would not be affected by changes in population. Long-term local residents would not confront large numbers of newcomers as outsiders, and communities would not experience conflict over the effects of outsiders on local conditions.

Local business and service activities also would not experience significant increases in the economies of the local or regional zones of influence.

Some small businesses dependent on a roadless setting outside of Wilderness may go out of business. A number of outfitter-guides who lead small hunting parties in remote areas may not be able to sustain their businesses if those areas are roaded (see effects of leasing on outfitter guides in Roadless Area, page IV-20).

None of the alternatives would result in major changes in current social conditions. Existing facilities and services are expected to be adequate to meet the increased demands of the relatively small work force needed to drill on newly leased lands.

Cumulative Effects

While total future drilling activity is expected to increase significantly from 1.4 wells annually to about 3.3 wells annually, drilling on new leases would not significantly affect future local Federal mineral receipts, Federal payments to State and County governments, employment and income, or social conditions. The effects from fluctuations in oil and gas prices, and the amount of activity from the anticipated 40 existing-lease wells will mask the effects of the anticipated seven new-lease wells. The annual average and the cumulative level of oil and gas activity over the planning period would be consistent with current conditions under all alternatives. Consequently, it would be unlikely that local conditions would change dramatically as a result of the projected oil and gas activity in the study area.

Floodplains

The potential impacts on Floodplains would generally be similar to those described for Riparian areas. Most of the time, in the analysis area, the Riparian zone and Floodplain of a stream encompass the same area. However, there may be places where the Floodplain lies outside the Riparian zone.

Alternative 1 - No Action

Activities in Floodplains would be restricted due to controlled surface occupancy. Road, well pad, and pipeline construction would be allowed, but location and design would be controlled. The potential for impacts would be lessened over the potential under *Standard Lease Terms*. The facilities in the Floodplain would be potentially impacted by a flood event. Flooding of a well pad or road could result in adverse impacts to surface and groundwater quality, potential property damage, and loss of life. Design appropriate for site conditions would lessen the potential for those impacts.

Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

This alternative would not allow surface occupancy in the Floodplain. This would lessen the potential for adverse impacts as a result of activities within the Floodplain environment.

Alternative 3 - No Lease

This alternative would not allow oil and gas activity to occur within the Floodplain. The potential for adverse impacts would be the lowest with this alternative.

Alternative 4 - Lease with Standard Lease Terms

This alternative would allow oil and gas activities within the Floodplain to occur without any special consideration for the potential impacts that could occur as a result of siting within the Floodplain. Of all the alternatives, this one has the highest potential for adverse impacts due to the flooding of a well pad or road. Water quality, both surface and subsurface, capital investments, and worker safety could be potentially affected.

Cumulative Effects

See cumulative effects discussion under the Aquatic (Fisheries) / Riparian / Wetlands Habitats on pages IV-66 and IV-67 of this chapter.

Aquatic (Fisheries) / Riparian / Wetland Habitats

Aquatic, Riparian, and Wetland ecosystems, generally thought to be the most important and productive habitat types found on the Forest, make up only a very small percentage of the analysis area (1-2%). Because of their importance, they are afforded protection under the various legislative authorities, executive orders and Forest policies and regulations. By regulation, "except as otherwise provided in the approved Surface Use Plan of Operations, the operator shall not conduct operations in areas subject to mass soil movement, Riparian areas and Wetlands". "Riparian areas", by definition, include the Aquatic ecosystem and the Riparian ecosystem and, for purposes of this discussion, Wetlands.

The potential for effects from oil and gas activities on fisheries, Aquatic habitat, water quality, Riparian habitat and Wetlands varies by alternative. Wetlands usually experience similar impacts as Riparian areas.

The majority of the potential impacts to Riparian areas would occur from road construction and location, culvert placement and stream crossings. These impacts can be compounded, depending on the time of year these activities are taking place, the mitigation efforts associated with these activities and what is happening in adjacent environments. Increased sediment loads, resulting from construction activities associated with oil and gas exploration and development would have the potential to cause the most adverse impacts on the Aquatic and Riparian resources.

Fisheries habitat would be impacted by the introduction of sediment which would "cement" the gravels by filling the interstitial spaces between the gravel particles. This would have severe impacts on the quality of spawning habitat and the rate of survival of the emerging fry. The timing of oil and gas activities could also have significant impacts on fry survival.

Other aquatic organisms would also be impacted, depending on the type of activities taking place, their location in relation to the stream channel and Riparian area and the time of year. Aquatic macroinvertebrates, the primary source of food for fish species, could be heavily impacted by the introduction of increased sediment loads. These organisms are much more sensitive to changes in environmental quality and would be more likely to be impacted by more subtle changes in habitat conditions. Because of their importance as a food source for fish, and in their functional roles in the processing of organic litter (allochthonous material), it is critical to consider the macroinvertebrate community when assessing impacts on Aquatic (and Riparian) ecosystems. The total biomass of aquatic macroinvertebrates may possibly remain the same, but the diversity of the community and thus the stability and quality of the food base may be significantly altered over the long-term by the increased

sediment loads, changes in temperatures, vegetative loss and overall impacts to water quality and physical habitat.

In addition to the obvious impacts from increased amounts of sediment and loss of vegetation, there is also the potential risk to habitat quality from the possibility of toxic materials being released into the Aquatic system from construction activities near or adjacent to the stream channel. Any spill of hazardous materials resulting from oil and gas exploration or development activities that ends up in the channel would have potentially significant impacts on the overall quality of the fisheries, including the fish species, macroinvertebrates and aquatic plants.

The importance of a healthy Riparian ecosystem to aquatic and terrestrial wildlife and for maintaining the integrity of the Aquatic ecosystem has been researched and discussed by Platts, Thomas, Davis, etc. When these Riparian ecosystems are disturbed, altered or destroyed, their functional role is also affected. These systems function in several ways: 1) they act as a filter in preventing silt and sediment from entering the Aquatic system; 2) they protect the watershed from erosional forces and reduce or modify the risk of flooding; 3) they preserve the normal stream channel cross-section and water table and provide for groundwater re-charge; 4) they provide for forage and cover for livestock and wildlife; 5) they provide fish food in the form of the various terrestrial invertebrates and provide habitat and food (detritus) for aquatic, semi-aquatic and terrestrial insects; and 6) they are the source of large organic debris, an essential contributor to aquatic diversity and stability.

Impacts to Aquatic/Riparian/Wetlands are considered in terms of what is happening in the Floodplains and the areas with Slopes 40-60%, Slopes > 60%, and Geologic Hazards.

Comparison of Alternatives

Least Potential for Impacts.....				.....Most Potential for Impact
Alt. 3.	Alt. 5	Alt. 2	Alt. 1	Alt. 4
No Lease	No Lease - Roadless and SPNM	Preferred	No Action	Lease with Standard Lease Terms

Alternative 1 - No Action

Under this alternative, the Aquatic, fisheries, Riparian and Wetland areas and Floodplains would be managed under *Controlled Surface Use*. It is expected that with the regulations that do not allow surface occupancy except as approved in a Surface Use Plan of Operations in Riparian areas, Wetlands and High Geologic Hazard areas, and Forest Plan standards and guidelines combined with the enforcement of the *Controlled Surface Use* stipulations, the impacts to these resources would be minimized. There is a potential for impacts to occur from activities associated with 40-60% Slopes, depending on the Riparian area's ability to "buffer" these impacts.

Alternative 2 - Preferred

This alternative falls in the moderate range for impacts to the Aquatic, Riparian and Wetland resources. Under this alternative, there would be *No Surface Occupancy* in Aquatic and Riparian areas and in Floodplains and areas with Slopes Greater than 60%. However, the stipulations associated with areas with Slopes 40-60% (*CSU*) and Moderate Geologic Hazard (*CSU*) may have the potential to cause some long-term significant impacts to Riparian areas and Floodplains. Depending on the nature of the activity, and the juxtaposition of 40-60% Slopes and Moderate Geologic Hazards to the Aquatic/Riparian resources, there is the potential for increased sediment loads to enter the Aquatic system and for the introduction of toxic materials. This would result in some significant impacts to fish and Aquatic organisms and their habitat.

Alternative 3 - No Lease

This would be the least impacting, to the Aquatic and Riparian systems, of all the alternatives.

Alternative 4 - Lease with Standard Lease Terms

This alternative would have the potential to have the greatest impacts on the Aquatic and Riparian systems. Application of *Standard Lease Terms* to all the *Affected Environments*, especially those not protected by law, regulation or Forest Plan standards and guidelines would result in significant long-term impacts to Aquatic, Riparian, Wetlands and Floodplains. This is due primarily to the fact that *Standard Lease Terms* are dependent on the agency's ability to administer and monitor oil and gas leasing activities and enforce regulations. Because of the inherent sensitivity of these Aquatic and Riparian ecosystems and their interdependence upon each other for maintaining habitat quality, the potential for irreversible impacts from this alternative is high.

Alternative 5 - No Lease in Roadless and SPNM

In terms of providing protection to the Aquatic and Riparian areas, this alternative would result in greater benefits to these resources than would the Alternative 2 - Preferred. This difference is related to the manner in which the Roadless Areas would be managed. *No Lease* in Roadless Areas would result in long-term benefits to the Aquatic and Riparian resources, over and above the current situation. Floodplains, Aquatic/Riparian and Wetlands, High Geologic Hazard, Slopes 40-60% and Slopes > 60% are given the same consideration under Alternative 2 - Preferred and this alternative.

Cumulative Effects

Impacts to Riparian areas (including the Aquatic ecosystem, Riparian ecosystems and Wetlands) are caused primarily from the introduction of sediment caused by road construction and location, culvert placement and stream crossings. These increased sediment loads can also be a result of increased traffic, better access for recreationists, and the overall ability of the Riparian vegetative complex to function in protecting the Aquatic and Riparian resources.

In order to estimate the potential impacts to the Aquatic and Riparian ecosystem, it is critical to consider how other *Affected Environments*, such as Floodplains, High Geologic Hazard, Slopes 40-60% and Slopes Greater than 60% are treated. In addition to the specific *Affected Environments*, an assessment should be made of the potential impacts resulting from increased activities brought on by increased access opportunities. Indirect impacts from road construction, additional timber harvest, increased traffic, livestock grazing, a rise in hunting and fishing activities, increased ORV use and dispersed camping can all have long-term cumulative impacts on the Aquatic and Riparian habitats.

In the ideal situation, Riparian areas would be in good to excellent condition throughout the analysis area enabling them to function properly in filtering sediments, providing cover, stabilizing stream banks, controlling temperatures, and providing organic input and habitat for aquatic, semi-aquatic and terrestrial organisms. However, in the analysis area, the condition of Riparian areas varies from poor (due to recreation and livestock use) to good, with some in excellent condition. As a result, the cumulative impacts, based on the current condition of the Riparian areas, may be more severe in some areas than in others.

Stipulations applied to current leases are generally not as restrictive as those proposed under the preferred alternative, therefore, any increased cumulative impacts would probably be minimal compared to the potential impacts currently being experienced under the existing situation. The potential for increased cumulative impacts is primarily a result of the relationship between additional road construction, increased public access, projected timber sale activities and recreational use, and increased ORV use. All of these uses compound the potential for increased sediment into the Aquatic Riparian system, greater loss and damage to the Riparian area, causing it to become nonfunctional in

terms of the protection provided to the Aquatic resources, and the potential for increased pollutants into the Aquatic system.

The overall cumulative impacts resulting from the new leases may be considered insignificant when looking at the potential for continued impacts caused from existing leases. However, when considering the increased activities as a result of improved access, the impacts may take on a greater significance.

Alpine / Tundra Areas

Alternative 1 - No Action

There exists a very high potential for irreparable soil and ecosystem damage to occur in the Alpine/Tundra environment under current management concepts of *Controlled Surface Use*. Any construction activities in these areas would drastically alter them into situations that are irreversible and irretrievable. The overall risk for this to occur is low, however, because of a low level of proposed drilling activity in Alpine/Tundra areas.

Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

These alternatives would protect the Alpine/Tundra environment from surface disturbance *(NSO)*. Oil and gas activities would not be allowed in these areas.

Alternative 3 - No Lease

This alternative would result in no additional effect to Alpine/Tundra environments.

Alternative 4 - Lease with Standard Lease Terms

The use of *Standard Lease Terms* would cause disturbances in Alpine/Tundra areas that would result in unacceptable soil, visual, and vegetation resource damage. Even with mitigation measures discussed for Alpine/Tundra areas, some long term scars from ground disturbance are likely to result from oil and gas activities. Without mitigation measures, damage to the other resources would exceed tolerable limits. The potential result is an area that is irretrievably and irreversibly altered.

Cumulative Effects

Very little activity, other than recreational use occurs in Alpine/Tundra areas. The effects in Alpine/Tundra from oil and gas (if allowed to occur) would likely be direct effects - not cumulative effects.

Areas of High Geologic Hazard

Regardless of alternative, High Geologic Hazard areas, as previously discussed, are subject to Forest Service regulations which do not allow the operator to occupy the surface, unless as approved in a Surface Use Plan of Operations (36 CFR 228.108(j)).

These areas are very susceptible to ground disturbing activities. Changes in the distribution of the soil and/or rock mass could result in acceleration of the slope movement. Road, well pad, or pipeline construction across these areas need to be very carefully designed and constructed. Alternatives including avoidance should be considered.

Cumulative Effects

The potential for cumulative effects in High Geologic Hazard areas is low. Under all alternatives, the Forest Service oil and gas regulations do not allow surface occupancy unless approved in a SUPO. The approval process would address the potential for slope failure through appropriate design and mitigation measures.

Areas of Moderate Geologic Hazard

Alternative 1 - No Action
Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

These alternatives allow activity in areas of Moderate Geologic Hazard under a *Controlled Surface Use* stipulation. Road, well pad, and pipeline construction through these areas would be subject to design by qualified engineers or engineering geologists. Even with special design and careful location of facilities, there would be potential for the occurrence of mass soil movement in the form of landslides, earthflows, and mudflows. As a result of mass soil movement, sediment may be deposited in streams, facility maintenance costs may increase, land would be taken out of vegetative production, and it may result in a long-term eyesore.

Alternative 3 - No Lease

This alternative would result in no additional effect to areas with a Moderate Geologic Hazard.

Alternative 4 - Lease with Standard Lease Terms

This alternative could result in roads, well pads, and pipelines constructed through areas of Moderate Geologic Hazard without consideration of the potential for mass soil movement as a result of the construction. Usually facilities can be constructed through these areas without causing adverse environmental impacts if special consideration is given to the soil properties, slope aspect and steepness, and groundwater. If not, as allowed with this alternative, the potential for adverse affects to the soil, water, and other resources remains high.

Cumulative Effects

The potential for cumulative effects in Moderate Geologic Hazard areas is low. In areas of concentrated activity (both past and current), i.e., oil and gas drilling, road construction and timber harvest, the potential for cumulative effects would be considered in project design. This would mitigate the potential for adverse cumulative effects to areas prone to slope failure.

Roadless Areas

The effects of oil and gas activities in Roadless Areas are discussed in detail earlier in this chapter under lease options. Those alternatives under which oil and gas activity would be authorized in Roadless Areas could result in impacts as described. Impacts to Roadless Areas are discussed relative to whether or not leasing would be allowed. If Roadless Areas are available and authorized for leasing for oil and gas resources, it is assumed that the decision to develop the Roadless Area has been made. The lease grants the lessee the right to build and maintain necessary improvements in the drilling for oil and gas subject to, among other requirements, stipulations attached to the lease. Alternatives allowing development in a Roadless Area would result in a loss of the roadless character and potential for inclusion in the National Wilderness System. The range of possible activity described in the RFD shows a possible additional seven wells somewhere in the entire analysis area. Whether industry would choose to put

one or more of these in Roadless Areas, if leased, is conjectural at this point. However, there is that possibility. In that event those areas entered would be lost as roadless and potential Wilderness resources.

Fourteen of the nineteen Roadless Areas within the analysis area currently have leases. Regardless of the alternative chosen in this EIS, activity could occur in the Roadless Areas with existing leases. As stated elsewhere in the EIS, additional NEPA analysis would be done prior to ground disturbance such as road construction, drilling, etc. Under current direction, an EIS would be required.

Table IV-4 summarizes by alternative the percentage of each lease option in each Roadless Area, for all *Affected Environments* present in the Roadless Area.

TABLE IV-4. LEASE OPTION PERCENTAGES IN ROADLESS AREAS, BY ALTERNATIVE

Roadless Area Number - Name	Lease Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
181 - Raggeds	NL	0	19	100	0	100
	NSO	6	7	0	0	0
	CSU	33	16	0	0	0
	CSU + TL	60	57	0	0	0
	TL	<1	0	0	0	0
	SLT	<1	1	0	100	0
182 - Drift Creek	NL	0	0	100	0	100
	NSO	1	7	0	0	0
	CSU	46	46	0	0	0
	CSU + TL	52	46	0	0	0
	TL	0	0	0	0	0
	SLT	1	1	0	100	0
184 - Springhouse Park	NL	0	0	100	0	100
	NSO	0	0	0	0	0
	CSU	34	34	0	0	0
	CSU + TL	32	32	0	0	0
	TL	10	10	0	0	0
	SLT	14	14	0	100	0
185 - Electric Mountain	NL	0	0	100	0	100
	NSO	3	3	0	0	0
	CSU	86	86	0	0	0
	CSU + TL	0	0	0	0	0
	TL	0	0	0	0	0
	SLT	11	11	0	100	0

TABLE IV-4. LEASE OPTION PERCENTAGES IN ROADLESS AREAS, BY ALTERNATIVE

Roadless Area Number - Name	Lease Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
186 - Clear Creek	NL	0	0	100	0	100
	NSO	3	13	0	0	0
	CSU	65	57	0	0	0
	CSU + TL	22	20	0	0	0
	TL	1	1	0	0	0
	SLT	10	9	0	100	0
189 - Hightower	NL	0	0	100	0	100
	NSO	2	15	0	0	0
	CSU	54	45	0	0	0
	CSU + TL	43	39	0	0	0
	TL	0	1	0	0	0
	SLT	1	0	0	100	0
191 - Priest Mountain	NL	0	57	100	0	100
	NSO	3	11	0	0	0
	CSU	80	28	0	0	0
	CSU + TL	4	2	0	0	0
	TL	0	0	0	0	0
	SLT	13	3	0	100	0
192 - Salt Creek	NL	0	0	100	0	100
	NSO	2	83	0	0	0
	CSU	58	13	0	0	0
	CSU + TL	15	0	0	0	0
	TL	0	0	0	0	0
	SLT	26	4	0	100	0
193 - Battlement Mesa	NL	0	0	100	0	100
	NSO	18	100	0	0	0
	CSU	62	0	0	0	0
	CSU + TL	19	0	0	0	0
	TL	0	0	0	0	0
	SLT	1	0	0	100	0

TABLE IV-4. LEASE OPTION PERCENTAGES IN ROADLESS AREAS, BY ALTERNATIVE

Roadless Area Number - Name	Lease Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
194 - Nick Mountain	NL	0	0	100	0	100
	NSO	3	62	0	0	0
	CSU	96	36	0	0	0
	CSU + TL	0	1	0	0	0
	TL	0	0	0	0	0
	SLT	1	1	0	100	0
195 - Kannah Creek	NL	0	100	100	0	100
	NSO	27	0	0	0	0
	CSU	25	0	0	0	0
	CSU + TL	48	0	0	0	0
	TL	0	0	0	0	0
	SLT	0	0	0	100	0
196 - West Elk	NL	0	26	100	0	100
	NSO	9	10	0	0	0
	CSU	77	53	0	0	0
	CSU + TL	2	0	0	0	0
	TL	1	0	0	0	0
	SLT	11	11	0	100	0
200 - Whetstone Mountain	NL	0	100	100	0	100
	NSO	35	0	0	0	0
	CSU	57	0	0	0	0
	CSU + TL	0	0	0	0	0
	TL	0	0	0	0	0
	SLT	8	0	0	100	0
201 - Flat Top Mountain	NL	0	100	100	0	100
	NSO	0	0	0	0	0
	CSU	100	0	0	0	0
	CSU + TL	0	0	0	0	0
	TL	0	0	0	0	0
	SLT	0	0	0	100	0

TABLE IV-4. LEASE OPTION PERCENTAGES IN ROADLESS AREAS, BY ALTERNATIVE

Roadless Area Number - Name	Lease Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
241 - Roubideau	NL	0	100	100	0	100
	NSO	1	0	0	0	0
	CSU	53	0	0	0	0
	CSU + TL	26	0	0	0	0
	TL	0	0	0	0	0
	SLT	20	0	0	100	0
242 - Tabeguache	NL	0	100	100	0	100
	NSO	4	0	0	0	0
	CSU	2	0	0	0	0
	CSU + TL	83	0	0	0	0
	TL	7	0	0	0	0
	SLT	4	0	0	100	0
243 - Kelso Mesa	NL	0	0	100	0	100
	NSO	2	2	0	0	0
	CSU	53	53	0	0	0
	CSU + TL	0	0	0	0	0
	TL	0	0	0	0	0
	SLT	45	45	0	100	0
246 - Campbell Point	NL	0	0	100	0	100
	NSO	0	0	0	0	0
	CSU	0	0	0	0	0
	CSU + TL	55	55	0	0	0
	TL	45	45	0	0	0
	SLT	0	0	0	100	0
247 - Johnson Creek	NL	0	0	100	0	100
	NSO	21	22	0	0	0
	CSU	6	6	0	0	0
	CSU + TL	71	71	0	0	0
	TL	2	1	0	0	0
	SLT	0	0	0	100	0

TABLE IV-4. LEASE OPTION PERCENTAGES IN ROADLESS AREAS, BY ALTERNATIVE						
Roadless Area Number - Name	Lease Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
TOTAL	NL	0	36	100	0	100
	NSO	9	22	0	0	0
	CSU	60	27	0	0	0
	CSU + TL	21	10	0	0	0
	TL	1	1	0	0	0
	SLT	8	4	0	100	0

Alternative 1 - No Action
Alternative 4 - Lease with Standard Lease Terms

These alternatives would make all Roadless Areas in the analysis area available for oil and gas leasing. The roadless character and the areas potential for inclusion in the National Wilderness System would potentially be lost.

Alternative 2 - Preferred

This alternative would not allow leasing in the Tabeguache, Roubideau, and Kannah Creek Roadless Areas. *No Surface Occupancy* would be applied in the Battlement Mesa Roadless Area. The Kebler Pass and Snowshoe Mesa portion of the West Elk Roadless Area, as well as the Kebler Pass portion of the Raggeds Roadless Area would not be available for leasing. This is also true of the Flat Tops south of the Silver Spruce Trail, the Currant Creek, the Upper Cow Creek, and the Priest Mountain portions of the Priest Mountain Roadless Areas (see Figure III-8a). This alternative would maintain the roadless character and attributes of the areas described above, but the remainder of the Roadless Areas would be available for leasing and subject to potential impacts to the roadless character of all or part of the Roadless Area. Thirty-six percent (36%) of the Roadless Area acreage in the Analysis Area would not be available for oil and gas leasing. Eleven percent (11%) of the Roadless Area in the Analysis Area would be available, but with *NSO* to protect the roadless values (Battlement Mesa).

Alternative 3 - No Lease

With this alternative, none of the analysis area, including Roadless Areas, would be available for oil and gas leasing. None of the Roadless Areas would lose roadless character as a result of oil and gas activity. Those Roadless Areas already under lease would potentially be subject to oil and gas activity and the impacts associated with activity.

Alternative 5 - No Lease in Roadless and SPNM

This alternative would have similar effects to that of Alternative 3, but this alternative would allow oil and gas activity outside of Roadless Areas and those areas with a Semi-primitive Non-motorized management prescription (3A).

Cumulative Effects

The existence of Roadless Areas and Wilderness within a reasonable distance of the analysis area is summarized in Appendix I. This lends some perspective to the impact that the potential losses of Roadless Areas to oil and gas development would have on the availability of roadless and Wilderness recreation opportunities within 100 miles of Delta, Colorado.

As development occurs on the Forest, more and more Roadless Areas are becoming subject to commodity driven development of natural resources. Outside of Wilderness, fewer and fewer opportunities exist for primitive and semi-primitive recreational experiences. Those providers of primitive and semi-primitive recreational opportunities such as outfitters, are being squeezed into smaller and smaller areas where they can take their customers for that type of recreational experience. Most of the Roadless Areas within the analysis area are currently leased and subject to the potential for environmental effects relating to the loss of roadless character and attributes.

See also the Cumulative Effects discussion under Wildlife, pages IV-58 and IV-59.

Connected Actions

The affects of possible connected actions such as timber sales following oil and gas access is discussed under lease options (pages IV-20 through IV-22). See also discussion page II-7.

Economics as Affected by Roadless Area Decisions: There is no measurable difference among alternatives in terms of local economies. The seven additional wells predicted in the RFD would remain the same regardless of whether all or none of the Roadless Areas were made available and authorized for leasing. The only effect would be the displacement of drilling activities.

The economic loss which would result from removal of each of, or all of, these Roadless Areas from availability for oil and gas development is impossible to precisely calculate. Even the presence of oil or gas resources is conjectural. It is reflected, to the best of our knowledge, in the maps showing areas of oil and gas potential (Figure III-2), in Chapter III. However, the amount of activity anticipated by the RFD would result in the placement of seven wells somewhere in the analysis area. Alternatives range from 951,450 to 0 acres of lands available and authorized for leasing under standard stipulations. Even if the RFD were incorrect by 300%, placement of seven to 21 wells somewhere in this area, excluding Roadless Areas does not, in our opinion, cause any economic loss to the industry. The decision to not make these Roadless Areas available for leasing does not result in any permanent commitment of resources, but rather indefinitely defers allowing activities in them while protecting the roadless/Wilderness values. Oil and gas resources which may be important to the nation at some time in the future would not be lost, but rather just not available at this time.

It is possible that some individual or company has had a particular interest in a parcel which is within these Roadless Areas, and that not being able to lease that particular parcel will seem damaging to that individual interest. However we do not have access to any such information (such information is closely guarded by prospective lessees in the competitive leasing market). Further we have no reason to believe that the economic interest of such an individual would not be just as well served by leasing and drilling in some other location on the Forest with the same "potential" for the presence of oil and gas resources.

Research Natural Areas

Alternative 1 - No Action

Alternative 1 would allow oil and gas activity to occur within a Research Natural Area under a *Controlled Surface Use* stipulation. Activity may be restricted and specific mitigation required. However, any activity such as road, well pad, or pipeline construction within an RNA would not be compatible with the intended use of the RNA. RNA's typically are reserved for study of a natural, undisturbed by man, environment.

Alternative 2 - Preferred
Alternative 3 - No Lease
Alternative 5 - No Lease in Roadless and SPNM

These alternatives would result in no effect on Research Natural Areas. *(No Lease)*

Alternative 4 - Lease with Standard Lease Terms

Oil and gas activities would be allowed in a Research Natural Area under this alternative. No special mitigation measures, outside of "reasonable" as provided by *Standard Lease Terms* could be required. Oil and gas activity such as road, well pad, and pipeline construction would likely alter the natural character of the area and result in an altered environment. This would be in conflict with the intended uses of the RNA.

Cumulative Effects

Very little ground disturbance occurs in Research Natural Areas. If oil and gas activity were to occur, the effects would likely be direct, rather than cumulative.

Sensitive Areas

Alternative 1 - No Action

Controlled Surface Use in Sensitive Areas would result in some loss of the attributes that make these areas sensitive. Typically, it would be a loss in scenic values that are important to a broad cross section of the American public. There is strong negative feelings towards timber harvest and road building within these Sensitive Areas (Forest Plan ROD). Logically, the same would be true of oil and gas activities that result in some timber harvest and the construction of roads.

Activity would potentially result in some loss to the recreation industry that depends on the maintenance of these kinds of environments in Western Colorado.

Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

These alternatives would not allow surface occupancy within a Sensitive Area. Access to oil and gas resources would have to come from outside the area. These alternatives would result in no additional impact to Sensitive Areas.

Alternative 3 - No Lease

Sensitive areas would not be available for leasing with this alternative and thus no additional effects would occur to Sensitive Areas as a result of oil and gas activity.

Alternative 4 - Lease with Standard Lease Terms

The effects of this alternative would be similar to, if not greater than the effects of Alternative 1.

Cumulative Effects

Very little ground disturbance has occurred or is likely to occur in the future in Sensitive Areas . As a result, any effect of oil and gas activity would likely be direct and not cumulative. Traffic associated with oil and gas activity on lands adjacent to Sensitive Areas may appear to create a cumulative effect

if it occurs at the same time and place as timber and recreation-related traffic. However, the effect would likely be short-term and localized.

Retention VQO, Retention VQO and Low VAC, and Scenic Byway Corridors

Analysis of the impacts of oil and gas activity on Retention VQO areas, Retention VQO - Low VAC areas and Scenic Byway corridors is based on typical historical and projected oil and gas activity at the well site, on new pipelines and on new roads.

The oil and gas development activities that are most likely to have a significant visual impact are those that take place during exploratory drilling, field development and production. Exploratory drilling is likely to cause the most significant change to the visual resource. Activities in the development and production stage may be less intrusive, but typically are longer lasting.

During exploratory drilling roads may need to be constructed to the site and a three acre level area or pad constructed. Until the well pad is completed and the drilling rig tested and (ultimately) removed, there will be some traffic to and from the site. An oil derrick on a drilling rig typically might be 150 feet high. The drill rig and site is lighted at night for safety and around the clock work. On average, a well rig can be expected to be in place and operating 30 to 60 days.

If the drilling is successful, operations will move into the development and production phases. If the oil and gas from the well does not flow naturally, a pumping unit may be required. These pumping units are generally twelve to fourteen feet high. If the well flows naturally, valves and pipes, ("Christmas tree") would be used to regulate flow. The Christmas tree unit can range from four to eight feet high. The visual impacts of development and production are less with a Christmas trees than with the pumping units.

Other facilities on the well site during the development and production phases include the treater and/or separator tanks, storage tanks, tool shed, generators and pipe racks. The separator tanks have a vertical orientation and can be as high as twenty feet. Storage tanks are typically fifteen feet high. Tool shed, generators and pipe racks vary between eight and twelve feet high. Pipelines interconnect the flow or pumping unit, the separators and the storage tanks.

Any new roads or upgrading of existing roads can also have a visual impact. Roads on steep slopes and pipelines with their linear openings in vegetation can be seen from long distance.

Alternative 1 - No Action
Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

These alternatives would include a *No Surface Occupancy* stipulation for Retention VQO - Low VAC areas and a *Controlled Surface Use* stipulation for Retention VQO areas and Scenic Byway Corridors. With these stipulations the adopted VQO's for the analysis area would generally be met except for minor impacts within Scenic Byway Corridors.

The overall effect on scenery within the analysis area would be minimal. These alternatives would result in the area generally retaining its natural characteristics. Further effects on the visual resources will be determined at the APD stage. Computer generated perspective plots would be useful in determining affects on visual resources. Of the seven wells within the RFD scenario, the four on the Grand Mesa National Forest are most likely not to meet their adopted VQO. This is because of the number of proposed new wells and its concentration of Retention VQO, scenic byways and other viewer platforms.

Alternative 3 - No Lease

This alternative would result in no additional leasing of oil and gas parcels within the analysis area. This alternative would have no environmental consequences on the visual resource (scenery). This alternative would maintain most of the visual resource in its existing visual condition.

Alternative 4 - Lease with Standard Lease Terms

This alternative would have the most potential to impact to the visual resource of any of the alternatives. With this stipulation the adopted VQO's for 19% of the analysis area may be adversely impacted. (See also pages IV-5 and IV-6.)

This alternative could result in much of the area changing from what is now a natural appearing visual condition to one that is heavily modified during the exploration phase. The activity described under the RFD could occur anywhere within the analysis area. The adopted VQO's would not be met in Retention and Partial Retention areas during the exploration phase.

Cumulative Effects

Historically, most of the existing leases, where the majority of the oil and gas exploration and development is proposed, are not in Retention or Partial Retention VQO areas. The remaining area covered in this leasing analysis has experienced a low level of oil and gas exploration and development. The RFD only predicts seven exploration wells will be drilled. Because of the absence of wells in Retention and Partial Retention VQO areas and the low number of wells being proposed in these areas, the anticipated cumulative effects of this leasing decision on the visual resource at both the exploration and production stages would be minimal.

Semi-primitive Non-motorized (3A Management Areas)

Discussed under recreation pages IV-54 to IV-56 of this chapter.

Administrative Sites and Utility Corridors/Electronic Sites

Analysis of the impacts of oil and gas development on Administrative Sites and Utility Corridors/Electronic Sites is based on typical historical and projected oil and gas activity at the well site, on new pipelines and on new roads. Utility corridors include electric transmission lines and oil and gas transmission pipelines.

The oil and gas development activities that are most likely to have a significant impact are those that take place during exploratory drilling, field development and production. Exploratory drilling has the most potential to cause significant impacts to Utility Corridors/Electronic Sites and administrative facilities. Activities in the development and production stage may be less intrusive, but typically are longer lasting.

Alternative 1 - No Action
Alternative 4 - Lease with Standard Lease Terms

These alternatives would lease Utility Corridors/Electronic Sites and Administrative Sites under the *Standard Lease Terms*. Well pads and roads would be located to save existing structures etc., but the effects of oil and gas activity such as noise, odors, and visual distractions may reduce the quality of the local environment. These alternatives would have the most potential for impact of any of the alternatives to Utility Corridors/Electronic Sites and Administrative Sites. Significant effects could

occur if a drill tower were to come in contact with one of the electric transmission lines, punctures a gas line or runs a diesel engine around the clock next to employee living quarters.

Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

These alternatives stipulate *No Surface Occupancy* for Administrative Sites and *Standard Lease Terms* for Utility Corridors and Electronic Sites. While this would protect the capital investments, some visual and audio impacts may occur.

Two of the Administrative Sites, Mesa Lakes and Ward Lakes, are included in Developed Recreation Complexes and the effect on them would be minimal based on the protection provided Recreation Complexes. The other Administrative Sites may be impacted by the sights, sounds and dust of an adjacent drill pad. Sites would be located to protect existing structures etc., but the effects of noise, odors, and visual distractions may reduce the quality of the local environment. Where these sites provide employee housing such as at Silesca, impacts on the quality of employee housing would be reduced.

Alternative 3 - No Lease

This alternative would result in no additional leasing of oil and gas parcels within the analysis area. This alternative would have no environmental consequences on the Administrative Sites or Utility Corridors and Electronic Sites. This alternative would maintain these sites in their existing setting.

Cumulative Effects

Historically, most of the existing leases, where the majority of the oil and gas exploration and development is proposed, are not within or adjacent to Utility Corridors, Electronic Sites or administrative facilities. The RFD only predicts seven exploration wells will be drilled. Because of the absence of wells in this environment and the low number of wells being proposed in this environment, the anticipated cumulative effects of this leasing decision on this environment would be minimal.

Recreation Complexes

Discussed under recreation, pages IV-54 to IV-56 of this chapter.

Watersheds of Special Interest to Municipalities

None of the domestic supply watersheds include the exploratory units where the majority of new wells are forecast. Some of the domestic watersheds do have existing leases; Kannah Creek - 10%, North Kannah Creek - 52%, Whitewater Creek - 37%, Big Creek - 42%, Cottonwood Creek - 22%, Dirty George Creek - 43%, Leroux Creek - 11%, Surface Creek - 11%, Bell Creek - 3% and Ward Creek - 96%. There would likely be some activity on these existing leases, but it would not be of sufficient intensity to jeopardize the water supplies to dependent communities. However, it will be important to recognize the importance of these watersheds at the time a APD is submitted and to safeguard water quality by including necessary conditions of approval and mitigation measures.

Alternative 1 - No Action
Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

Domestic supply watersheds would all be fully protected with *Controlled Surface Use* stipulations. This would result in the strict control of location of certain facilities in relationship to important features

within the domestic supply watershed. An example would be the control over well pad locations. Under *Controlled Surface Use* we could require that well pads be located a specified distance from water intakes.

Alternative 3 - No Lease

This alternative would result in no additional impacts to domestic watersheds.

Alternative 4 - Lease with Standard Lease Terms

Domestic supply watersheds would not receive any special protection in their entirety, but as mentioned above those water quality sensitive environments within the watersheds would be protected. Mitigation will be specified under Conditions of Approval to the APD that further protect water quality in domestic supply areas. However, our ability to control location of certain facilities would be lacking.

Cumulative Effects

The projected level of oil and gas activity and related ground disturbance is so low that when added to the effects of timber sale and recreational activity (including past, present and future) in municipal watersheds, no cumulative watershed effects would be likely to occur. See also Water Quality discussion pages IV-45 through IV-48.

Slopes 40-60%

Alternative 1 - No Action
Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

These alternatives stipulate *Controlled Surface Use* on Slopes 40-60%. The location and design of well pads, roads or pipelines on these slopes would be carefully studied. With mitigation measures as described in Appendix H the potential for adverse impacts would be minimized.

Alternative 3 - No Lease

This alternative would result in no additional impacts to Slopes 40-60%. Oil and gas activities would not be allowed on these slopes.

Alternative 4 - Lease with Standard Lease Terms

For the proposed seven new wells that may occur throughout the analysis area, the use of *Standard Lease Terms* would cause disturbances in sensitive soil areas that would result in unacceptable soil resource damage. These sensitive areas need measures that are above and beyond those in a typical standard lease option to control and mitigate soil damage. Without the extra measures, damage to the soil would exceed tolerable limits. The result would be an area that is irretrievably and irreversibly altered.

Cumulative Effects

Very little activity such as road construction and timber harvest is allowed to occur on these steep slopes. Oil and gas activity on Slopes 40-60% would be subject to Forest Service approval. No adverse cumulative effects would be likely to occur as a result of oil and gas activity, as the activity would be strictly controlled.

Slopes >60%

Alternative 1 - No Action
Alternative 2 - Preferred

The *No Surface Occupancy* stipulation on Slopes > 60% would maintain slope stability, erosion rates and environmental integrity to within natural rates.

Alternative 3 - No Lease

No Lease would result in no additional impacts to slopes in excess of 60%.

Alternative 4 - Lease with Standard Lease Terms

For the proposed seven new wells that may occur throughout the analysis area, the use of *Standard Lease Terms* would cause disturbances in sensitive soil areas that would result in unacceptable soil resource damage. These sensitive areas need measures that are above and beyond those in a typical standard lease option to control and mitigate soil damage. Without the extra measures, damage to the soil would exceed tolerable limits. The result would be an area that is irretrievably and irreversibly altered.

Cumulative Effects

Very little activity such as road construction and timber harvest is allowed to occur on these steep slopes. Oil and gas activity on Slopes > 60% would be subject to Forest Service approval. No adverse cumulative effects would be likely to occur as a result of oil and gas activity, as the activity would be strictly controlled.

Wildlife Special Habitats

Big Game Winter Range

Alternative 1 - No Action

Current Forest Plan direction can be interpreted to restrict road use and construction on winter range management areas 5A and 5B, to reduce impacts of human activity on wintering animals and limit the loss of habitat. This translates into *Controlled Surface Use* and *Timing Limitation* stipulations.

Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

Controlled Surface Use and *Timing Limitations* would specifically be applied to "critical" winter range areas, as identified by the Colorado Division of Wildlife (see Figure III-15). Similar Forest Plan direction would be applied to 5A and 5B management areas. Oil and gas activities would be conducted to limit impacts to wintering animals and existing habitat.

The effect of *No Lease* in Roadless Areas would result in big game remaining in these areas as long as weather conditions would allow, before these animals would move onto winter ranges.

Alternative 3 - No Lease

This alternative would result in no increased impacts to Big Game Winter Range as a result of oil and gas activities.

Alternative 4 - Lease with Standard Lease Terms

Standard Lease Terms may not provide the *Timing Limitations* needed to protect wintering big game. Big game would potentially be severely disrupted on their winter ranges and moved to less desirable habitats. This coupled with stress and a loss of fat reserves from movement, could result in the death of a large number of individuals.

Increased pressure on already overcrowded private ranches would result in concentrated herds which would increase the loss of individuals to disease, stress, and reduced food energy intake. These actions would significantly affect the economic benefits of having healthy wildlife populations from a sport hunting and wildlife viewing aspect to the local economies. Wildlife species requiring large home ranges, large areas of secure habitat, and strict cover requirements would be most adversely affected by this alternative because all Roadless Areas would be available for leasing and the potential for the subsequent roading of these secure wildlife habitats.

Cumulative Effects

The cumulative effects of oil and gas leasing and development, increased access and human activity would directly result in increased disturbance to animals; increasing stress and energy requirements. Animals can also be displaced into more marginal habitats or onto already occupied optimum habitat. This can result in overcrowding, forage over utilization, and increased chances of disease transmittal. Animals would seek refuge on private lands, compounding the current problem of animal damage claims against the CDOW. Access to private land is limited, which can result in lower hunter success and game management objectives may not be achieved.

Elk Calving Areas

Alternative 1 - No Action
Alternative 4 - Lease with Standard Lease Terms

The Forest Plan provides only general direction relating to providing cover buffers around elk calving areas, which fall within *Standard Lease Terms*. *Standard Lease Terms* would result in displacement of animals to less desirable birthing areas, or overcrowding of currently used areas. Animal movement during the critical periods of birthing and rearing, expose the animals to increased predation and stress. Direct habitat loss as a result of oil and gas activities would reduce habitat effectiveness.

Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

Controlled Surface Use would protect the birthing area habitat; *Timing Limitations* would restrict oil and gas activities during the birthing periods.

Due to the remoteness of Roadless Areas, birthing areas are often found in these areas. Additional protection of these areas would be achieved under Alternative 5. This alternative would also protect large acreages of security habitat adjacent to birthing areas.

Alternative 3 - No Lease

This alternative would result in no increased impacts to elk calving areas as a result of oil and gas activities.

Cumulative Effects

The cumulative effects of oil and gas leasing and development, and connected actions of increased access and timber sales has the potential to dramatically effect deer and elk birthing areas. Disruption of life cycles could cause a temporary or permanent displacement of wildlife populations. This disruption of normal activities and displacement could result in long term cumulative population losses because of reduced carrying capacity and increased mortality. Additional pressure would be placed on private lands to provide secure wildlife habitat. These private lands are already being sought after by big game populations because of the dwindling amount of secure undisturbed habitats on public lands.

Migration Routes and Staging Areas

Alternative 1 - No Action
Alternative 4 - Lease with Standard Lease Terms

Under these alternatives, special wildlife environments such as big game Migration Routes and Stating Areas would not be granted special protection. *Standard Lease Terms* would probably not mitigate the potential for effects these areas. Wildlife populations would be temporarily or permanently displaced, resulting in forage overuse, increased stress levels, and increased mortality. Additional pressure would be placed on private lands to provide secure wildlife habitat. These private lands are already being sought after by big game populations because of the dwindling amount of secure undisturbed habitats on public lands.

Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

Migration routes and staging areas would be protected under these alternatives *(CSU, TL)*. Activities will be restricted during the periods animals are using these areas. Having Roadless Areas protected will also reduce the animal pressure on these areas, because they will be able to utilize undisturbed areas for longer periods of the year.

Alternative 3 - No Lease

This alternative would result in no increased impacts to big game Migration Routes and Stating Areas.

Cumulative Effects

The cumulative effects of oil and gas leasing, anticipated oil and gas development, and connection actions of timber sales and increased human access will likely displace animals from existing Migration Routes and Stating Areas, into less desirable habitat, resulting in increased animal mortality, decreased habitat carrying capacity and potential increases in animal damage claims against the CDOW.

Bighorn Lambing and Breeding Areas

Alternative 1 - No Action
Alternative 4 - Lease with Standard Lease Terms

Rocky Mountain bighorn sheep lambing sites would be provided protection by Forest Plan standards and guidelines (restrictions on activity within a mile of these sites from May 1 through June 30).

Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

Protection (*No Surface Occupancy*) would be granted to the year-round range of the Battlement Mesa bighorn sheep herd under this alternative.

Alternative 3 - No Lease

This alternative would result in no increased impacts to bighorn sheep lambing and breeding areas as a result of oil and gas activities.

Cumulative Effects

The cumulative effects of oil and gas leasing, anticipated oil and gas development, and connection actions such as timber sales and increased human access could ultimately result is the disappearance of the Battlement Mesa bighorn sheep herd.

Summer Range (Concentrated Use)

Alternative 1 - No Action
Alternative 4 - Lease with Standard Lease Terms

Under this alternative, concentrated summer use areas would not be granted special protection. *Standard Lease Terms* would probably not mitigate the potential for effects on these areas. Disruption of normal activities and displacement could result in long term cumulative population losses because of reduced carrying capacity. Additional pressure would be placed on private lands to provide secure wildlife habitat. These private lands are already being sought after by big game populations because of the dwindling amount of secure undisturbed habitats on public lands.

Alternative 2 - Preferred

This alternative would protect concentrated use summer range areas with a *No Surface Occupancy* stipulation. No increased impacts to summering elk would occur as a result of implementation of this alternative.

Alternative 5 - No Lease in Roadless and SPNM

Much of the summer concentrated use areas occur in Roadless Areas. Protection of these areas would continue to provide large acreages of hiding and security habitat. The availability of these areas would result in animals remaining on the summer range as long as weather conditions allow. This would keep animals off the winter ranges and private lands for long periods.

Alternative 3 - No Lease

This alternative would result in no increased impacts to big game summer range as a result of oil and gas activities.

Cumulative Effects

The cumulative effects of oil and gas leasing, anticipated oil and gas development, and subsequent timber sales and increased human activities within summer concentrated use areas would adversely effect big game populations. Animals will be displaced to areas offering security - this is often private lands. The net results will include: decreased carrying capacity of habitats animals move into; increased stress, chance of disease transmission, and animal mortality; potential for increased animal damage claims; inability of achieving big game management objectives.

Sage Grouse Leks

The sage grouse represents species dependent on the sagebrush vegetative community. Sage grouse breeding grounds (leks) and winter habitat are most likely to be adversely affected by exploration or development.

Alternative 1 - No Action
Alternative 4 - Lease with Standard Lease Terms

These alternatives would allow oil and gas activities to occur in Sage Grouse Leks. This would result in disruption of the sage grouse at a critical time during it's life cycle. Braun (1987) stated that "with the discovery of oil and gas resources, especially in the 1930's and 1940's, impacts of energy development on wildlife resources in Western North America increased". Studies in North Park, Colorado (Colorado Division of Wildlife, unpublished data) suggest that sage grouse populations, as measured by counting males on leks, decreased dramatically during initial stages of oil field development. The decrease is related to loss of habitat caused by site preparation, road development and associated human disturbance. Leks are sagebrush vegetated areas where courtship, breeding, nesting, and brood rearing take place. Leks are traditional and absolutely necessary to the local sage grouse population. These areas and wintering grounds are essential habitat components necessary to maintain quality sage grouse habitat.

Alternative 2 - Preferred
Alternative 5 - No Lease in Roadless and SPNM

These alternatives protect Sage Grouse Leks by placing a *No Surface Occupancy* stipulation on the lek and within a 1/2 mile of the lek. Further protection is provided for nesting with *Controlled Surface Use* and *Timing Limitations* (3/31 - 5/31) within 2 1/2 miles of the lek. These measures would effectively mitigate the potential for adverse effects from oil and gas activities on these habitat areas.

Alternative 3 - No Lease

This alternative would result in no increased impacts due to oil and gas activities to Sage Grouse Leks.

Cumulative Effects

Oil and gas activity, in addition to past, present and future timber sales, recreation and range uses could potentially result in adverse cumulative effects to sage grouse and their leks.

Utility Corridors / Electronic Sites

See discussion on page IV-77 of this chapter.

Primary Rangeland (6B Management Areas)

Alternative 1 - No Action
Alternative 2 - Preferred
Alternative 4 - Lease with Standard Lease Terms
Alternative 5 - No Lease in Roadless and SPNM

These alternatives would result in Primary Rangelands being open to oil and gas leasing under the standard stipulations. Under this scenario is must be recognized that many grazing allotments, management systems, and livestock stocking rates, currently do not meet the ecological and use

conditions specified in the Forest Land and Resource Management Plan. Subsequently, any surface related disturbance which may remove or modify the forage produced on the Primary Rangelands may potentially compound such issues.

Activity on Battlement Mesa, if it occurs, would have the greatest potential to impact existing management systems and livestock stocking rates. The potential wells and associated road access and possible transmission corridors may have an impact on the Primary Rangelands and stocking rates associated with the Kimball, Hawxhurst, Brush Creek, Cheney, and Buzzard cattle allotments.

Under the projected scenario , it is estimated that a temporary reduction of less than 1 percent of existing permitted livestock numbers would result and require some form of mitigation. It is also anticipated that after construction, road access would have to be closed to the public to circumvent vandalism, and people harassment, in order to maintain existing management systems.

Throughout the study area, any earth disturbing activities associated with roads, drill pads, transmission corridors, etc., will increase the occurrence probability of noxious or undesirable plants. Without prompt mitigation treatment, the probability is estimated to increase from 50 percent, the first year after the disturbance, to 90 percent after three years.

With proper coordination, increased road access can be an asset to the permittee, in facilitating the construction of needed range improvements, and assisting with distribution and management of livestock.

Alternative 3 - No Lease

Limiting leases to the status quo would result in no negative environmental consequences to the vegetative cover comprising the Primary Rangelands of the study area. Issues associated with increased access, vandalism, theft, and people related disturbance to permitted livestock, would be maintained at current levels.

Opportunities would be foregone to capitalize on increased access from oil and gas development roads to transport range improvement materials, and facilitate ease of access associated with management of livestock and grazing permit administration.

Cumulative Effects

As more and more ground disturbance takes place on Primary Rangelands, the amount of forage and livestock carrying capacity declines. The level of activity projected from oil and gas would not likely result in an adverse cumulative effect on Primary Rangeland, unless the activity is concentrated in an area of extensive past, present and future timber harvesting.

Lands Suited for Timber Harvest

All lease alternatives would make Lands Suited for Timber Harvest available with *Standard Lease Terms*. Potentially, some of these lands may become more economically viable for timber harvest due to access provided by oil and gas exploration and development. This could result in some increase in the Forest's ASQ. (Before the Forest ASQ could be increased, environmental analysis and public participation would need to occur to amend the Forest Plan.) Note however, that these lands may also have resource values that would not allow the use of *Standard Lease Terms*.

The amount of timber harvested directly as a result of oil and gas activity (the construction of the road, well pad and pipeline corridor) would be related to the type of timber stand (if any) the construction activities would occur in. For the purposes of the analysis, 10.7 acres was used as an average amount of disturbance per well. Forty-seven (47) wells each having 10.7 acres of disturbance (possible timber

harvest) and an average of 10 mbf/acre would result in 5,029 mbf over the next 15 years, or 335 mbf/year. The Forest's ASQ is 38,800 mbf/year. The timber harvested as a result of oil and gas activity would count towards meeting the Forest's timber target although it amounts to less than 1% of the ASQ.

Alternative 3, would result in no additional effects to Lands Suited for Timber Harvest.

Cumulative Effects

It is not known how much timber might become suitable as a result of access to an area of previously economically not suitable timber (due to high road costs). There are approximately 61,000 acres of economically not suitable timber within the analysis area. At most, 610,000 mbf of timber (using an average of 10 mbf/acre) could become suitable if all the economically not suitable timber was accessed by oil and gas development roads. These acres could be added to the suitable base of 287,000 acres in the analysis area. This would be a maximum increase of 21%. As discussed earlier, any addition to the suitable base would have to be accomplished through a Forest Plan amendment.

The cumulative effect of road construction from the projected oil and gas activity could potentially result in a slightly increased Forest ASQ. See also the Connected Actions discussion on page II-7.

Additional Discussions

Effects of Alternatives on Consumers, Civil Rights, Minority Groups and Women

None of the alternatives would affect civil rights, minority groups or women.

Any alternative could affect consumers if oil and gas prices are kept lower or higher due to increased or decreased supplies of these items. Alternative 3 would remove all NFS lands from future leasing. The resultant loss of revenues could affect consumers during the 15 year planning period.

Effects of Alternatives on Prime Farm Land, Range Land and Forest Land

"Prime" range land and "prime" forest land does not apply to lands in the analysis area. None of the alternatives would affect prime farm land. Under all alternatives, National Forest System lands would be managed with a sensitivity to the effects on adjacent lands.

Effects of Alternatives on Wetlands and Floodplains

The 36 CFR 228 regulations preclude surface occupancy of Riparian areas. The management of Wetlands and Floodplains are subject to Executive Orders 11990 and 11988, respectively. The purpose of the executive orders are to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of Wetlands and Floodplains. Development of oil and gas wells in Riparian areas could cause significant effects to the water quality and Aquatic habitat. See pages IV-13 through IV-16, and IV-63 through IV-67.

The Preferred Alternative

The preferred alternative is Alternative 2. This alternative provides the greatest resource protection while leaving the majority of the National Forest System lands available for leasing. As discussed in more detail in Chapter 1 and the introduction to this Chapter, the Record of Decision will document three related decisions: a) Forest Plan Amendment; b) land availability decision; and c) specific lands authorization decision. The specific lands decision will be made for all lands administratively available for leasing, subject to monitoring prior to lease advertisement and sale, and another site-specific NEPA decision at the Application for Permit to Drill (APD) stage.

Irreversible and Irretrievable Commitment of Resources

An irreversible commitment of resources results from actions altering an area to the extent that future options are lost. The term "irreversible" applies primarily to the effects of use of nonrenewable resources, such as minerals, or to factors such as soil productivity that are renewable only over long periods of time. An irretrievable commitment of resources results from the loss of production, harvest or use of natural resources. Irretrievable losses are not necessarily irreversible losses.

Vegetation: Well pad constructions and road building would cause an insignificant irretrievable loss of timber production. This irretrievable loss would be insignificant even if all RFD wells actually occurred on sites suitable for timber harvest.

None of the alternatives would cause an irreversible effect on the vegetation resource, given monitoring requirements and the application of site-specific mitigation. However, revegetation mitigation would likely be costly and potentially long-term on the well sites.

Soils: Oil and gas activities could cause irreversible and irretrievable impacts on soil productivity on steep slopes and fragile soils associated with mountainous terrain if mitigation were to fail and accelerated erosion were to occur. These areas can be revegetated but the mitigation measures would be expensive. Shallow soils could also be subjected to irreversible and irretrievable losses in soil productivity, due to the high erosion rates and low reclamation potential. Mitigation would be expensive.

Water Quality: There is always the potential of a spill of wastes such as oil, salt water and drilling fluids, associated with oil and gas development. Mitigation measures are designed to make this potential as small as possible. However, any spill in a Riparian area would have direct and immediate impacts on the water resource due to the high water table. Any drilling would have the potential to impact groundwater resource. Such impacts would be long-term, irreversible and irretrievable.

Aquatic and Riparian: There are possible irreversible and irretrievable impacts to fishery and Riparian resources under Alternatives 1 and 4. This is due to the sensitive nature of Riparian areas that if not fully protected may not recover. Sediment and chemical spills may cause similar impacts to the fishery resources.

Range: All alternatives would cause a relatively minor short-term loss of forage production on most disturbed sites. Irretrievable long-term losses of forage production would occur where production facilities are constructed (tank batteries, system roads, etc.). Revegetation mitigation would minimize this effect.

Wildlife Habitat: The loss of forage production, mentioned above would have minimal impacts on wildlife habitat. The associated road construction, particularly in currently undeveloped areas would result in an irretrievable loss of habitat effectiveness resulting from forest fragmentation, for those species requiring large areas of secure habitat. Impacts would be minimized by limiting public access on new roads, and reclaiming these roads upon completion of oil and gas activities.

Roadless Areas: An irretrievable loss of roadless character would occur in any currently undeveloped area that is entered by oil and gas activities.

Minerals: The production of oil and gas under any of the alternatives would be an irreversible commitment of the oil and gas mineral resources. Under alternatives that apply *No Lease* and *No Surface Occupancy* stipulations, there may be an irretrievable commitment of these resources because they would not be available for development during the life of this document.

Chapter V -
List of Preparers

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Chapter V - List of Preparers

The Interdisciplinary Team

John Almy - Forest Hydrologist

B.S. Forest Hydrology

Five years experience as Forest Hydrologist in several Regions; four years experience as District Resource Assistant; two years experience as Liaison Officer for a powerline construction; two years as Hydrologist on a Planning Team.

Provided input on air quality, and water quality and quantity for General Forest, Riparian Areas, Wetlands, and Watersheds of Special Interest to Municipalities.

Ken Anderson - Timber Staff Officer

B.S. Forest Management Science

Two years Range Conservationist with the BLM at Resource Area level; seven years Sale Preparation Forester at District and Supervisor's Office (FS); five years as Appraisal Specialist at Regional Office; and one year in current position.

Provided input on forest vegetation and timber suitability.

A. Clair Baldwin - Forest Range Staff Officer

B.S. Range Management

Twenty-eight years experience in various positions at the District and Supervisor's Office level.

Provided input on rangeland vegetation, noxious weeds, and livestock grazing.

Jeff Burch - Planner

B.S. Forestry, M.S. Forestry

Twelve years as Planner at several Forest Supervisors Offices and a Regional Office; two years as forester for International Paper Company; one year as forester/planner for Tlingit and Haida Indian Tribes of Alaska.

Provided input on NEPA process, formulated alternatives, and facilitated open houses and the management team/interdisciplinary team decision meetings.

Jeff Cameron - Forest Fisheries Biologist

B.S. Biological Sciences, Graduate School Fisheries Biology & Entomology

Three years Assistant District Fisheries Biologist; eight years District Fisheries Biologist; four years Zone Fisheries Biologist.

Provided input on aquatic resources for the Aquatic/Riparian/Wetlands discussions.

Paul Dastrup - Transportation Planner

B.S. Civil Engineering

Eleven years civil engineer; three years Zone Engineer

Provided information on transportation system.

Daryl L. Gusey - Forest Geologist

B.S. Geology, M.S. Geology

Eleven years District Geologist; one year timber sale planner; and one year Forest Geologist.

Interdisciplinary Team Leader.

Tom Holland - Forest Wildlife Biologist

B.S. Wildlife Biology

One year Research Wildlife Biologist; one year Forester; seven years Zone Wildlife Biologist; seven years Forest Wildlife Biologist.

Provided information on wildlife and threatened and endangered species.

Terry Hughes - Forest Soil Scientist

B.S. Forestry, Soil Science Minor

Four years as field soil scientist with the Soil Conservation Service; sixteen years Forest Soil Scientist.

Provided information on soils.

John W. Oien - Landscape Architect

B.S. Environmental Design

Twenty-five years Landscape Architect; member of Forest Service Interdisciplinary Team.

Provided information on visual resources, developed and dispersed recreation, roadless areas, utility corridors, electronic sites, and administrative sites.

Mike Ward - Minerals and Lands - Paonia Ranger District

B.S. Forestry

Twenty-five years experience at the District level in timber, lands and recreation. The past 10 years in administration of energy mineral exploration and development.

Provided information on past oil and gas activity on the Forest.

Additional Preparers

Dulaney Barclay - Archaeologist

B.S. Geology, M.A. Anthropology

Three years experience as archaeologist on Grand Mesa, Uncompahgre and Gunnison National Forests.

Provided input on cultural and historic resources for the EIS.

Douglas Fehlmann - Geologist

B.S. Geology

Seven years experience as petroleum geologist in the oil and gas industry, two years experience as Geological Technician with Forest Service and three years experience as Cartographer, Cadastral Surveyor and GIS Digitizer with the BLM.

Mapped geologic hazards and completed all resource digitizing associated with EIS.

Lewis M. French - Forester - Ouray Ranger District

B.S. Forestry

Twenty years Forest Service experience: five years in timber management, 15 years in recreation, lands and minerals.

Prepared Roadless Area affected environment write-ups.

Carol S. Howe - Writer/Editor

B.S. Wildlife Science, Soil Science Minor

Three years Forest Service experience as Wildlife Biologist at District and Supervisor's Office level; six years experience as computer programmer with private industry.

Responsible for editing, writing and coordination of EIS.

Jerry Jones - Geologist (BLM)

B.S. Geology

Five years industry (consulting); sixteen years geologist with the BLM at various District Offices in Arizona, Oregon, and Colorado.

Provided input on ground water, geology, and oil and gas operations.

Jeffrey L. Ulrich - Operations Research Analyst

B.S. Biochemistry, M.S. Park & Recreation Resources, M.S. Forest Management

Fourteen years Forest Service experience at the District and Supervisor's Office levels.

Prepared socioeconomic analysis for EIS.

Bob Vlahos - Geographic Information System Coordinator (BLM)

B.S. Forest and Range Management

Ten years range conservationist; four years planning team; five years GIS Coordinator.

Provided GIS analysis and mapping.

Kermit Witherbee - Senior Technical Specialist - Petroleum Geologist (BLM)

B.S. Geology, M.A. Geology

Six years industry exploration geologist; ten years geologist with the BLM at various levels in the organization.

Provided the Reasonably Foreseeable Development scenario.