

SAN JUAN PUBLIC LANDS

Draft Land Management Plan • Draft Environmental Impact Statement

VOLUME 1 ■ Draft Environmental Impact Statement



U.S. DEPARTMENT OF INTERIOR

Bureau of Land Management
Dolores, Columbine, and Pagosa Field Offices

U.S. DEPARTMENT OF AGRICULTURE

U.S. Forest Service – Region 2
San Juan National Forest



PROPOSED ACTION LOCATION..... San Juan Public Lands
U.S. Department of Agriculture (USDA),
United States Forest Service (USFS)
U.S. Department of the Interior (USDI),
Bureau of Land Management (BLM)

Archuleta, Conejos, Dolores, Hinsdale, La Plata, Mineral,
Montezuma, Montrose, Rio Grande, San Juan, San Miguel Counties,
Colorado.

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This Draft Land Management Plan (DLMP) and Draft Environmental Impact Statement (DEIS) addresses future management options for approximately 1,867,800 acres of the San Juan National Forest, administered by the USFS; and approximately 500,000 surface acres and 300,000 acres of subsurface mineral estate administered by the BLM. The planning area is located in southwestern Colorado, in Archuleta, Conejos, Dolores, Hinsdale, La Plata, Mineral, Montezuma, Montrose, Rio Grande, San Juan, and San Miguel Counties. The BLM and the USFS in southwest Colorado are managed under a combined “Service First” partnership. The San Juan Public Lands Center (SJPLC) and its Ranger District/Field Offices (Columbine, Dolores, and Pagosa) are the joint USFS/BLM Service First offices responsible for the management of the public lands and resources considered in this DLMP/DEIS. Information provided by the public; BLM and USFS personnel; other Federal, State, and local governmental agencies; Native American tribal agencies and organizations; and special interest and community organizations has been used to develop and analyze the four land management alternatives and the oil and gas leasing alternatives considered in detail in this document. Alternative A, the No-Action Alternative, represents the continuation of current management direction. Alternative B, the Preferred Alternative, which is described in detail in Volume 2 of this DLMP/DEIS, provides for a mix of multiple-use activities, with a primary emphasis on maintaining most of the large, contiguous blocks of undeveloped lands and enhancing various forms of recreation opportunities while, at the same time, maintaining the diversity of uses and active forest and rangeland vegetation management. Alternative C provides for a mix of multiple-use activities, with a primary emphasis on preserving the undeveloped character of the San Juan public lands. Alternative D provides for a mix of multiple-use activities, with a primary emphasis on preserving the “working forest and rangelands” character of the lands administered by the SJPLC in order to produce the highest amounts of commodity goods and services. Additionally, these alternatives, plus a no-leasing alternative, are described as part of the USFS oil and gas leasing availability analysis.

USFS MISSION STATEMENT

The phrase, “Caring For The Land And Serving People,” captures the USFS mission, which is to sustain the health, diversity, and productivity of the nation’s forests and grasslands in order to meet the needs of present and future generations. As set forth in law, the USFS mission is to achieve quality land management under the sustainable multiple-use management concept in order to meet the diverse needs of people.

BLM MISSION STATEMENT

The BLM is responsible for the balanced management of BLM-administered lands and resources, and their various values, so that they are considered in a manner and combination that best serves the needs of the American people. Management is based upon the principles of multiple use and sustained yield. This combination of uses takes into account the long-term needs of future generations for renewable and non-renewable resources. These resources include recreation, range, timber, minerals, watershed, fish and wildlife, as well as wilderness and natural, scenic, scientific, and cultural values.

INTRODUCTION

In accordance with the National Environmental Policy Act of 1969 (NEPA, 42 USC 4321 et seq.), the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976, (NFMA, Sec. 6, 16 USC 1600.), and the Federal Land Policy and Management Act of 1976 (FLPMA, 43 USC 1701 et seq.), the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS), in southwest Colorado, in cooperation under a “Service First” partnership, have prepared a Draft Land Management Plan/Draft Environmental Impact Statement (DLMP/DEIS) for the public lands under their jurisdiction. The San Juan Public Lands Center (SJPLC), and its Ranger District/Field Offices (Columbine, Dolores, and Pagosa), are the joint USFS/BLM Service First office responsible for the management of the public lands and resources considered in this DEIS/DLMP. In fulfillment of these, as well as all other legal, regulatory, and policy requirements, this DLMP/DEIS documents the comprehensive analysis of alternatives and environmental impacts for the planning and management of public lands and resources administered by the SJPLC exclusive of the Canyons of the Ancients National Monument which has a stand alone Resource Management Plan being developed.

The purpose, or goal, in developing this DLMP/DEIS is to ensure that USFS- and BLM-administered lands, resources, and mineral estate are managed in accordance with applicable laws, as well as with the principles of multiple use and sustained yield. The public lands in this administrative area, although under the care and management of the USFS and the BLM, belong to the American people; thus, it is the overriding goal of these agencies to actively seek out, engage, and include the public, and all other interested parties, in this planning process--a process that could shape how visitors perceive, experience, use, and enjoy their public lands. The USFS and the BLM encourage the public to review and comment on the DLMP/DEIS, and to raise concerns, if any, about proposed management.

THE PLANNING AREA

The planning area discussed in this DLMP/DEIS is located in southwestern Colorado, in Archuleta, Conejos, Dolores, Hinsdale, La Plata, Mineral, Montezuma, Montrose, Rio Grande, San Juan, and San Miguel Counties. The western border of the planning area is the Utah/Colorado State line. The southern border of the planning area is the New Mexico/Colorado State line. The eastern border is the Continental Divide. The northern border is the administrative boundaries of the Rio Grande, Gunnison, Grand Mesa, and Uncompahgre National Forests, and the BLM Uncompahgre Field Office. This DLMP/DEIS will provide a framework to guide future management decisions on approximately 1,867,800 acres of the San Juan National Forest, administered by the USFS, and approximately 500,000 surface acres and 300,000 acres of subsurface mineral estate administered by the BLM.

THE EXISTING BLM/USFS LAND MANAGEMENT PLANS

The San Juan Public Lands are currently being managed under the following land use plans:

- ***The San Juan/San Miguel Resource Management Plan (BLM 1985)***: The current Resource Management Plan (RMP) was approved in 1985, and has been amended five times. It provides management direction for what is now the SJPLC and its four Field Offices: Dolores, Columbine, Pagosa, Canyons of the Ancients National Monument (CANM). A separate RMP is being prepared for CANM)
- ***The San Juan National Forest Land and Resource Management Plan (USFS 1983)***: The current San Juan National Forest Land and Resource Management Plan (also known as a Forest Plan) was approved in 1983, with a major amendment in 1992 and twenty additional amendments. This DLMP/DEIS has been prepared using the provisions of the 1982 planning rule (36 CFR 219), as provided by the 2004 interpretative rule that clarified the transition provisions of the planning rule adopted on November 9, 2000. The current 1983 plan provides direction for the San Juan National Forest and its three Ranger Districts: Dolores, Columbine and Pagosa.

MANAGEMENT ALTERNATIVE GOALS AND OBJECTIVES

Four land management alternatives, and their associated environmental impacts and related issues, are described and analyzed in this document. Additionally, oil and gas leasing alternatives, including the no lease alternative, are described and analyzed. The alternatives reflect a reasonable range of potential management actions, based on the Analysis of the Management Situation (AMS); Federal, State, local, and other governmental agency input and consultation; Native American tribal agency input and consultation; and public scoping. The alternatives in this DLMP/DEIS seek to fully address the changing needs of the planning area, with the goal of selecting a management strategy that best achieves an effective combination of management actions, including one that:

- addresses all of the BLM-administered and USFS-administered public lands and resources administered by the SJPLC (exclusive of CANM);
- employs a community-based planning approach that complies with all applicable local, State, Federal, and Native American tribal laws, standards, policies, and implementation plans, as well as with all BLM and USFS policies, guidelines, and regulations;
- recognizes all valid existing rights;
- complies with the FLPMA, the NFMA, the National Environmental Policy Act (NEPA), and all other applicable laws, rules, regulations, standards, policies, and guidelines;
- coordinates and consults with Native American tribes in order to identify sites, areas, and/or objects important to their cultural and religious heritages;
- identifies management actions and allowable uses anticipated to achieve the established goals and objectives, and to reach the desired outcomes;
- provides comprehensive management direction by serving as a basis for land use decisions for all appropriate resources and resource uses administered by the SJPLC;
- establishes goals and objectives (desired outcomes) for managing resources and resource values according to the principles of multiple use and sustained yield;
- identifies land use planning decisions that will serve to guide future land management actions and subsequent site-specific implementation decisions;

- considers current scientific information, research, new technologies, as well as the results of relevant resource assessments, monitoring, and coordination;
- considers current and potential future uses of the public lands and resources administered by the SJPLC through the development of reasonable foreseeable future developments and activity scenarios based on historical, existing, and projected levels of use;
- recognizes the Nation’s needs for domestic sources of minerals, food, timber, and fiber, and incorporates the requirements of the Energy Policy and Conservation Act Reauthorization, the Energy Policy Act, the National Fire Plan, the Healthy Forest Restoration Act, and the Healthy Forest Initiative;
- retains flexibility so that the USFS and BLM can adapt to new and emerging issues and opportunities, and provide for adjustments to decisions over time, based on new information and monitoring; and
- strives to be compatible with existing plans and policies of adjacent local, State, Federal, and Native American tribal agencies, consistent with Federal law, regulations, and BLM and USFS policy.

ISSUES

Planning issues identify demands, concerns, and/or conflicts regarding the use or management of public lands and resources. These issues typically express potential impacts on land and on resource values. The main topic areas addressed in this DLMP/DEIS were identified based on input from interagency consultation, State government, cooperating agencies, internal review, as well as input from the public, industry representatives, and special interest groups. The identified issues represent the challenges that exist with current management and with the current BLM and USFS land management plans. The SJPLC has documented each of the issues in a scoping report.

The public scoping process invited interested parties to comment on, and contribute input with regard to, the planning process. On September 23, 1999, a Notice of Intent (NOI) to revise the USFS Land Management Plan (LMP) for the San Juan National Forest was published in the Federal Register. On December 14, 2004, a second NOI was published, updating timelines and informing all interested parties that the BLM Resource Management Plan (RMP) would be revised concurrently.

Four main issues drove the development of alternatives for this DLMP/DEIS. The alternatives reflect where people had notably different ideas about how to manage and/or how to use different areas administered by the SJPLC. These different ideas came from the community study groups, web-based interaction, as well as from scoping meetings, written comments, and other scoping activities. These issues include the following:

- ***Issue One - Balancing Management Between the Ideas of Maintaining “Working Forests and Rangelands” and of Retaining “Core Undeveloped Lands”***: Here, issues and concerns included balancing the concepts of a “working forest and rangelands” (respecting valid and existing rights to resources, retaining access and commodity production activities that are important to the economy of local communities, and continuing historical uses in areas where access and infrastructure investments have already been made) with that of retaining “core undeveloped areas” (retaining areas that have not been developed in order to provide high-quality wildlife habitat and corridors, minimize ecosystem fragmentation, and support natural ecosystem functions). Maintaining the roadless character of much of the public lands in the planning area was identified as important by wildlife managers, sportsmen, and by many interested citizens.

- **Issue Two - Providing Recreation and Travel Management Within a Sustainable Ecological Framework:** Here, issues and concerns included the need to find a balance between the way long-time residents, new arrivals, and visitors use the public lands with regard to recreation and travel management. Opinions were divided on where to emphasize motorized travel versus non-motorized travel. Issues and concerns also included the appropriate mix of different kinds of recreation settings and opportunities that should be provided on public lands in the planning area.
- **Issue Three - Management of Special Areas and Unique Landscapes:** Here, issues and concerns include debate about which areas should be recommended for special designations and/or managed in order to emphasize unique features. Special designations would include Forest Service wilderness recommendations, suitability of rivers for Congressional designation into the Wild and Scenic Rivers System, Research Natural Areas, Areas of Critical Environmental Concern, botanical, archaeological, and habitat areas, scenic, historic and backcountry byways, and national, recreation and scenic trails. Issues and Concerns also included alternative ways of managing some unique landscapes, including the Dolores River Canyon, Silverton, Rico, McPhee and the HD Mountains.
- **Issue Four - Managing Impacts from oil and Gas Leasing and Development:** Here, issues and concerns included providing for potential energy development while, at the same time, protecting other resource values. People expressed concern with both where and how development might occur.

ALTERNATIVES

Land use planning regulations and NEPA require the USFS and the BLM to develop a range of reasonable alternatives during the planning process. The basic goal of developing alternatives is to prepare different combinations of management scenarios in order to address all identified issues and to resolve conflicts among uses. Alternatives must meet the purpose and need; must be reasonable; must provide a mix of resource protection, use, and development; must be responsive to the issues; and must meet the established planning criteria (See Volume 1, Chapter 2). The alternatives proposed for this DLMP/DEIS were developed with varying Management Area (MA) allocations and objectives in order to focus on resolving these issues and concerns (see Table 1). Additionally, oil and gas leasing availability alternatives are described in detail, including the no leasing alternative, and are described for both FS and BLM administered resources to accommodate both USFS and BLM leasing availability requirements and decision making authorities.

A number of other alternatives were considered, but were not analyzed in detail (See Volume 1, Chapter 2). Each of the alternatives proposed for this DLMP/DEIS provides a framework for multiple-use and sustained-yield management of the full spectrum of resources, resource uses, and programs present in the planning area. The alternatives analyzed in this DLMP/DEIS represent a reasonable range in management actions and each has a different blend or balance of resource allocations and protections, resource uses, and potential impacts, as summarized below:

- **Alternative A:** Alternative A, the No-Action Alternative, is the continuation of present management under the existing BLM and USFS land management plans. This alternative meets the requirements of the National Environmental Policy Act of 1969 (40 CFR Part 1502.14) that a no-action alternative be considered (“no-action” means that current management practices based on existing land use plans and other management decision documents would continue.) This alternative would serve as a baseline for comparing the impacts of the other alternatives. Direction from existing laws, regulation, and policy would also continue to be implemented. Under this Alternative, the current levels of products, services, and outputs of multiple-use and sustained-yield management of the public lands and resources administered by the SJPLC would continue, except for fluctuations due to budget. Activities such as timber harvesting and oil and gas development would potentially occur over a greater percentage of the planning area under Alternative A than they would under the other alternatives.
- **Alternative B:** Alternative B, the Preferred Alternative, would provide for a mix of multiple-use activities, with a primary emphasis on maintaining most of the large, contiguous blocks of undeveloped lands and on enhancing various forms of recreation opportunities while, at the same time, maintaining the diversity of uses and active forest and rangeland vegetation management. Alternative B is focused on balancing the ideas of maintaining “working forest and rangelands” and of retaining “core, undeveloped lands.” Uses and activities that require roads, such as timber harvesting and oil and gas development, would be focused in areas that already have roads. Relatively undeveloped areas and areas that currently do not have roads would, for the most part, remain that way. This alternative would represent a mix and a variety of actions that would resolve the issues and management concerns raised during public scoping, in consideration of all of the resource values and all of the management programs. (Alternative B, the Preferred Alternative, is described in detail in Volume 2 of the DLMP/DEIS.)
- **Alternative C:** Alternative C would provide for a mix of multiple-use activities, with a primary emphasis on the undeveloped character of the lands and resources administered by the SJPLC. Production of goods from vegetation management would continue, but might be secondary to other non-commodity objectives. Under Alternative C, production of goods and services would be slightly more constrained than that proposed under Alternatives A, B, and D. And, in some cases and in some areas, uses would be excluded in order to protect sensitive resources. Management provisions under this alternative would emphasize retaining the undeveloped character of large blocks of contiguous land and non-motorized recreational activities to a greater degree than would any of the other alternatives.
- **Alternative D:** Alternative D would provide for a mix of multiple-use activities, with a primary emphasis on the “working forest and rangelands” concept in order to produce the highest amounts of commodity goods and services, when compared with the other alternatives. Similar to Alternative A, this alternative would allow the greatest extent of resource use within the planning area while, at the same time, maintaining ecosystem management principles in order to protect and sustain resources. Under this alternative, potential impacts to sensitive resource values would be mitigated on a case-by-case basis.
- **No Leasing Alternative:** The no-leasing alternative is analyzed in compliance with 36 CFR 228.102(c)(2)&(3) which requires the Forest Service, when considering oil and gas leasing, to analyze an alternative of not leasing. Under this alternative acres not already withdrawn by law from leasing would be administratively not available for leasing. Under this alternative, only existing leases would continue to be developed. Any new leases would be deferred, pending a new analysis and decision (See Table 2).

Table 1 - Comparison of Land Allocations by Alternative

MANAGEMENT AREAS	Alternative A (No-Action Alternative)	Alternative B (Preferred Alternative)	Alternative C	Alternative D
MA 1 Natural Processes Dominate ¹	538,658	652,307	1,080,606	553,786
MA 2 Special Areas and Unique Landscape Areas	100,755	193,503	198,512	151,040
MA 3 Natural Landscape with Limited Management	891,718	825,000	472,022	788,289
MA 4 High-Use Recreation Emphasis	148,465	79,711	54,765	86,236
MA 5 Active Management (commodity production in order to meet multiple-use goals)	675,014	529,413	487,299	682,632
MA 7 Public and Private Lands Intermix	0	81,756	71,929	89,116
MA 8 Highly Developed Areas	14,475	7,395	3,952	17,986
Total Acres	2,369,085	2,369,085	2,369,085	2,369,085

¹ Under all of the alternatives, MA 1 would include 420,522 acres that are currently designated as Wilderness (Lizard Head, South San Juan, and Weminuche); 60,341 acres in the Piedra Area that are currently managed in order to maintain Wilderness characteristics, as directed by the 1993 Colorado Wilderness Act; and 55,428 acres of BLM Wilderness Study Areas.

Table 2 - Oil and Gas Leasing Availability by Alternative on USFS and BLM Lands

Oil and Gas Leasing Availability on San Juan Public Lands	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D	No Lease Alternative
San Juan National Forest Fluid-Minerals - Oil and Gas (acres)					
Acres Withdrawn From Leasing	480,953	480,953	480,953	480,953	480,953
Acres Proposed for Withdrawal	0	67,726	532,957	0	0
Acres Administratively Not Available for Leasing	0	20,371	20,371	20,371	1,392,474
Acres Available for Leasing	1,392,474	1,304,377	839,146	1,372,103	0
No Surface Occupancy (NSO)	1,705	741,524	278,232	810,994	0
Controlled Surface Use (CSU)	169,485	248,636	265,420	235,850	0
CSU and Timing Limitations (TL)	559	77,176	73,089	69,843	0
Timing Limitations	1,390	69,935	67,826	71,693	0
Standard Lease Terms	1,219,355	167,106	154,579	183,723	0
BLM Fluid-Minerals - Oil and Gas (acres) <i>(figures are based on total mineral estate, including private surface)</i>					
Acres Withdrawn From Leasing	0	0	0	0	0
Acres Proposed for Withdrawal	0	0	0	0	0
Acres Administratively Not Available for Leasing	63,851	72,867	98,450	72,867	768,625
Acres Available for Leasing	704,804	695,758	670,175	695,758	0
No Surface Occupancy (NSO)	39,036	238,578	239,413	233,005	0
Controlled Surface Use (CSU)	201,022	55,286	55,153	56,947	0
CSU and Timing Limitations (TL)	57,641	12,762	12,521	15,831	0
Timing Limitations	113,915	264,019	238,095	264,782	0
Standard Lease Terms	293,160	125,113	124,993	125,194	0

ENVIRONMENTAL CONSEQUENCES

Volume 1, Chapter 3 of this DLMP/DEIS describes the environmental consequences that could result from the varying mix of land allocations (management area) and management emphasis of the alternatives. In Chapter 3 potential beneficial/adverse consequences are analyzed and discussed for each resource and program area.

Potential environmental impacts vary by projected outputs levels of management activities such as oil and gas development, timber harvest, road construction/reconstruction, fuel treatments, livestock grazing, recreation use (including mode of travel). To varying degrees across the alternatives, uses and activities would be affected by special designations including, but not limited to, areas recommended for Wilderness, Research Natural Areas, Areas of Critical Environmental Concern, Botanical Areas, and Archeological Areas.

Alternatives A and D place the most emphasis on commodity production; have the most land in MA 5, and the least restrictions on activities. This would probably result in higher levels of ground disturbance with more potential impacts to soil and water resources, wildlife and fisheries habitat, air quality, and scenery. Alternatives A and D also provide more opportunities for motorized recreation, with more potential conflicts with nonmotorized recreation. Alternatives A and D also result in higher levels of employment, income, revenues to State and local governments, and net revenues than the other alternatives.

Alternative C places the most emphasis on maintaining the undeveloped character of the area and has the most land in MA 1; has the largest acreages recommended for Wilderness, Research Natural Areas, Wild and Scenic Rivers, and other special designations. It has the lowest levels of commodity production and the most restrictions on activities. This would probably result in the lowest levels of ground disturbance with the least potential impacts to soil and water resources, wildlife and fisheries habitat, air quality, and scenery. Alternative C provides the most opportunities for nonmotorized recreation, with the fewest opportunities for motorized recreation. Alternative C would result in lower levels of employment, income, revenues to State and local governments, and net revenues than the other LMP alternatives (the no leasing alternative would have even lower levels).

Alternative B emphasizes a balance between commodity production and maintaining the undeveloped character of the area. It also emphasizes management of a number of unique landscapes for their special characteristics. It would probably result in lower levels of ground disturbance with less potential impacts to soil and water resources, wildlife and fisheries habitat, air quality, and scenery than under Alternatives A and D, but more than under Alternative C. Alternative B provides the most balance between motorized and nonmotorized recreation. Alternative B resolves the most potential conflicts among users of the San Juan Public Lands.

The No Lease Alternative would result in the lowest level of ground disturbance associated with oil and gas development with the fewer potential impacts to soil and water resources, wildlife and fisheries habitat, air quality, and scenery. It would result in lower levels of employment, income, revenues to State and local governments, and net revenues.

INTRODUCTION

Paleontological resources, plant and animals fossils, are the remains and traces of once-living organisms, now preserved in rocks of the Earth's crust. They convey the story of origins and endings of extraordinary varieties of ocean-dwelling, fresh-water, and terrestrial creatures that have lived on the Earth.

LEGAL AND ADMINISTRATIVE FRAMEWORK

Paleontological (fossil) resources are natural resources that occur on public lands; therefore, they are managed in accordance with the requirements of several Federal laws, primarily the Federal Land Policy Management Act (FLPMA) of 1976 and the National Environmental Policy Act of 1969 (see below). Additional requirements for the use, management, and protection of paleontological resources on public lands are addressed in a series of Federal Regulations and Secretarial Orders, as well as in specific BLM manual guidance. Other guidance has resulted from key court decisions and Solicitor's Opinions.

LAWS

- ***The Common Varieties of Mineral Materials Act of 1947***: This act allows the protection of petrified wood on public lands.
- ***The National Environmental Policy Act of 1969***: This act covers the policy for documentation of effects (impacts) of Federal actions on natural resources on public lands.
- ***The Federal Land Policy and Management Act of 1976***: This act substantially amends the Forest and Rangeland Renewable Resources Planning Act of 1974. This act strengthens the references pertaining to suitability and compatibility of land areas, stresses the maintenance of productivity, and seeks to avoid the permanent impairment of the productive capability of the land.
- ***The Federal Cave Resources Protection Act of 1988***: This act serves to secure, protect, and preserve significant caves on Federal lands for the perpetual use, enjoyment, and benefit of all people; and to foster increased cooperation and exchange of information between governmental authorities and those who utilize caves located on Federal lands for scientific, education, or recreational purposes.

REGULATIONS AND POLICIES

- ***Title 43 CFR 3620, Subpart 3622***: This sets agency policy for recreational collecting of common invertebrates and petrified wood on public lands.
- ***Title 43 CFR, Subpart 37***: This addresses the protection of significant caves and cave resources, including paleontological resources.
- ***Title 43 CFR, Subpart 8365***: This addresses the collection of invertebrate fossils and, by administrative extension, fossil plants.
- ***Title 43 CFR, Subpart 3622***: This addresses the free-use collection of petrified wood as a mineral material for non-commercial purposes.

- **Title 43 CFR, Subpart 3621:** This addresses the collection of petrified wood for specimens exceeding 250 pounds in weight.
- **Title 43 CFR, Subpart 3610:** This addresses the sale of petrified wood as a mineral material for commercial purposes.
- **Title 43 CFR, Subparts 3802 and 3809:** These address the protection of paleontological resources from operations authorized under the mining laws.
- **Title 43 CFR, Subpart 8200:** This addresses procedures and practices for the management of lands that have outstanding natural history values, including fossils, which are of scientific interest.
- **Title 43 CFR, Subpart 8365.1-5:** This addresses the willful disturbance, removal, and/or destruction of scientific resources or natural objects and Subpart 8360.0-7 identifies the penalties for such violations.
- **Secretarial of the Interior Order 3104:** This grants the BLM the authority to issue paleontological resource use permits for lands under its jurisdiction.
- **BLM Manual 8270:** This outlines policy for the management of paleontological resources.

USFS and BLM policy is intended to manage paleontological resources for scientific, educational, and recreational values, and to protect or mitigate these resources from adverse impacts. To accomplish this goal, paleontological resources must be professionally identified and evaluated, and paleontological data must be considered as early as possible in the decision-making process.

The USFS is developing manual direction for the management of paleontological resources on USFS-administered lands. Currently, the BLM direction is in use for USFS lands. Fossil collection on USFS-administered lands is regulated under 36 CFR 261.9(i), which prohibits “excavating, damaging, or removing any vertebrate fossil or removing any paleontological resource for commercial purposes without a special use authorization.”

A classification system called the Probable Fossil Yield Classification (PFYC) was developed by the USFS Paleontology Center of Excellence and the Region 2 Paleo Initiative in 1996 in order to promote consistency throughout, and between, agencies (USFS 1996). The PFYC system provides baseline guidance for assessing the relative occurrence of important paleontological resources, and the need for mitigation. Geologic units are classified at the formation or member level, according to the probability of yielding paleontological resources of concern to land managers. Classifications range from Class 1 to Class 5, and are based on the relative abundance of vertebrate fossils, or uncommon invertebrate or plant fossils, and their sensitivity to adverse impacts. A higher classification number indicates a higher fossil yield potential and a greater sensitivity to adverse impacts. (See Appendix Y, Volume 3, for a description of the 5 PFYC classes and the suggested management direction indicated for each class.)

DESIGN CRITERIA

Management guidelines and design criteria describe the environmental protection measures that would be applied to all of the alternatives at the project level in order to protect, enhance, and, where appropriate, improve paleontological resources. Guidelines and design criteria are presented in Part 3 of Volume II of the DLMP/DEIS.

AFFECTED ENVIRONMENT

Existing Conditions and Trends

Paleontological resources are integrally associated with the geologic rock units (e.g., formations) in which they are located. If extensive excavation on a certain formation in one geographic area leads to discovery of significant paleontological resources, there is a potential that excavations throughout the extent of the formation may also produce fossil material. Within the planning area, formations have differing potentials to contain significant fossils. Other areas may also contain fossils, but have not been examined and evaluated. The potential for paleontological resources is currently noted through the use of the PFYC System. No comprehensive study or evaluation of paleontological resources has been conducted in the planning area. (See Appendix Y, Volume 3, for a description of formations known to have potential for the occurrence of paleontological resources.)

In 1899, Walter Granger of the American Museum conducted the first paleontological work in the area. Since that time, scientific investigation has been sporadic, and no comprehensive paleontological investigation of the area has been conducted. A great deal of the area is remote; therefore, paleontologists have relied upon reports of fossil localities by ranchers, rock-hounds, and/or by the public. Unfortunately, by the time some localities are reported to the SJPLC, many have already been looted.

Potential Paleontological Resources

Fossils found within the planning area are Jurassic and Cretaceous in age. They include various plants (mostly as petrified wood), invertebrates, and vertebrates (mostly dinosaurs). Within the planning area, formations are classified into categories that indicate the likelihood of significant fossil occurrence. The geological formations that are known to contain significant vertebrate, invertebrate, and plant fossils include, but are not limited to, the following in the planning area (BLM 1991):

- San Jose (vertebrate/dinosaurs);
- Mancos Shale (invertebrates, skate or ray teeth, ammonites, pelecypods, scaphites, oysters, gastropods, baculites, and stromatolites);
- Dolores (flowering plants);
- Morrison (vertebrates and invertebrates);
- Chinle (vertebrate/fish, and plants);
- Mesa Verde (invertebrates); and
- Navajo Sandstone (diverse ichnofauna (e.g., protomammal, dinosaur, pterosaur, crocodile, lizard, and invertebrate traces); petrified wood; remains of prosauropod and theropod dinosaurs; aetosaur; and therapsid vertebrate fossils).

The BLM identified the Morrison Formation as having the potential for fossil occurrences within the planning area (O'Neal 1989). The Morrison Formation is also the focus of the vanadium and uranium mining that has occurred historically on public lands and Department of Energy (DOE) leases. Vanadium and uranium mining is expected to increase during the planning horizon. Most of the planning area has not been surveyed for paleontological resources; therefore, the extent of occurrences of most paleontological resources is not known. The San Juan/San Miguel RMP (BLM 1985) provided for limited recognition of vertebrate paleontological resources in the identification of the Horse Range Mesa site (Morrison Formation), which was evaluated by Brigham Young University (BYU) (Stadtman and Miller 1989).

Visitors to public lands are welcome to collect reasonable amounts of many kinds of fossils without a permit. These materials, however, must be for personal collections and cannot be sold or traded. No permit is needed for plant fossils (including leaves, stems, and cones), or for common invertebrate fossils (including ammonites and trilobites). Petrified wood may be collected, up to 25 pounds each day (but no more than 250 pounds in any calendar year) for each individual. A permit is needed for the collection of vertebrate fossils, which are any remains or traces of animals with backbones (including dinosaur bones, fish, teeth of any kind, turtle shells, and trace fossils). Trace fossils include coprolites, which are fossilized waste (feces), tracks, and trackways. Generally, permits are only issued to professional paleontologists, who must agree to preserve their finds in a public museum, a college, or a university due to their relative rarity and scientific importance.

Within the planning area, the “demand” for paleontological resources is considered low to moderate. The principal legal use of the paleontological resource is for research, or for the viewing fossils in their natural surroundings. Collection in the name of scientific research is conducted under permits issued by the SJPLC. (Recreational use of fossils may include their viewing and noting their differences from other rocks while on outings.) No collection of vertebrate fossils is allowed without a Colorado BLM Paleontological Resource Use Permit or a USFS Special Use Permit. Illegal collection of fossils has occurred on both a commercial and casual basis.

Safeguards against incompatible land and resource uses may be imposed through withdrawals, stipulations on leases and permits, design requirements, and similar measures developed and recommended by an appropriately staffed interdisciplinary team.

The natural processes of weathering and erosion impact paleontological resources by continually exposing fossilized material. Lower rates of erosion expose fossils, but delay their destruction; higher rates expose fossils, but more quickly destroy them. This varying rate of erosion allows a window of time in which a fossil might be discovered, properly identified, and studied.

Due to recreational activity, minimal localized degradation of geologic features, with their inherent fossil deposits, is expected to continue. Exposed fragile fossils may be degraded by casual OHV and mountain bike use that occurs off of existing or established routes.

The condition of paleontological resources may improve through the availability of educational information to the public regarding the nature of paleontological resources. Allowing appropriate scientific collecting by permit may help build the knowledge base of the scientific aspects of fossils, formations, and geology.

ENVIRONMENTAL CONSEQUENCES

DIRECT AND INDIRECT IMPACTS

Federal undertakings and unauthorized uses have the potential to result in irreversible disturbance and damage to non-renewable paleontological resources. The SJPLC would continue to mitigate impacts to paleontological resources resulting from authorized uses through project abandonment, redesign, and specimen recovery. Geologic formations with exposures containing vertebrate and non-vertebrate fossils may continue to be impacted as the result of natural agents, unauthorized public use, mining, and vandalism.

The casual use and collection of non-vertebrate fossils by “rock-hounds” and fossil collectors is expected to increase. Scientific interest in vertebrate fossils by the academic community is expected to remain at current levels.

Proposed management of the following resources/resource uses/programs may have no anticipated impacts to paleontological resources: Air, Cultural Resources, Fisheries, Geology, Soils, Invasive Species, Vegetation, Riparian Areas, Visual Resources, Water, Wildlife Habitat, Renewable Energy, Environmental Justice, Health and Safety, Native American Trust Resources, and Social Considerations.

Management measures common to all alternatives may preserve and protect paleontological resources for present and future generations. Adverse impacts may be mitigated through specimen recovery and analysis by professional paleontologists.

Under all of the alternatives, the greatest risk of damage or destruction of paleontological resources may result from casual, unauthorized activities (including dispersed recreational activity, OHV-use, and vandalism), mining of vanadium/uranium, and natural processes (including natural decay, deterioration, or erosion). Under all of the alternatives, unquantifiable indirect impacts may occur. Wilderness Areas, WSAs, and other Special Designation Area management may reduce the access to potential paleontological resources, as would the management of rivers for the outstanding remarkable values (ORVs) identified for suitable Wild and Scenic River (WSR) designation.

Impacts to paleontological resources within the planning area may result from actions proposed under the following resource management programs that have the potential to disturb fossil bearing geologic formations: Minerals Development, Vegetation and Fire and Fuels, Recreation, Lands and Realty, Trails and Travel Management; and Special Designation Areas.

DLMP/DEIS Alternatives: Under Alternative D, fewer limits would be placed on mineral development activities (including for roads, oil and gas exploration, and vanadium and uranium mining), when compared to Alternatives B and C. This may increase the potential for impacts to paleontological resources. Management of the Dolores Canyon Special Management Area may continue to provide protection to paleontological resources under all of the alternatives. Direct and indirect impacts may be minor under all of the alternatives.

Impacts Related to Minerals Development Management

Oil and Gas Development - Oil and gas development may disturb the surface exposure of geologic formations bearing fossils. Formations with potential for paleontological resources also tend to be within areas with high potential for oil and gas discovery. This disturbance may result from direct impacts from a drill pad excavation or from the increased accessibility of a fossil locality by the construction of an access road. In some rare cases, the surface exposure of a formation is the last remnant of that formation. In these cases, it would be desirable to protect significant fossils within this remnant formation from disturbance. In other cases, the fossils may be distributed throughout a massive formation; however, the significance of the fossils would require protection of the entire formation. In most cases, preservation of individual outcrops is unimportant, either due to the lack of significance, wide distribution, or absence of fossils.

When fossils are identified, existing law would protect significant fossils from adverse impacts related to oil and gas development. Under all of the alternatives, prior to the approval of a permit to drill (APD), identified sites must be proven to have no significant fossils, or appropriate mitigation measures must be taken. For areas of 40 acres or less, mitigation would usually mean avoidance of the site. If a site could not be avoided, and if the disturbed area was significant, it would have to be excavated or the resource otherwise protected. This protection would be provided for in the standard terms and conditions of all oil and gas leases. Leases in areas designed for protection would also carry a NSO stipulation. This stipulation would be used on all formally designated areas of more than 40 acres.

The small percentage of unavoidable loss may be an irreversible and irretrievable commitment of the resource. The unavoidable loss would be insignificant, in relation to the widespread distribution of the resource. Currently, the only identified site within the planning area is the Horse Range Mesa Paleontological site (40 acres), where there is a NSO Stipulation in place for the protection of vertebrate fossils, and an exception criterion (including funding of accredited paleontological excavation in order to recover all vertebrate fossils to the point of scientific insignificance). Through avoidance or required collection, impacts in this area may be minimal and short-term.

A scenario of deferring oil and gas leasing during the life of the approved LMP may result in moderate impacts to potential fossil resources with less than 25% change. This is because values can normally be protected by avoiding surface use of land.

Uranium/Vanadium Mining

Surface-disturbing activities authorized by the mining programs (including mineral-exploration projects and extraction of mineral resources) may result in adverse direct and indirect impacts to paleontological resources. The impacts may be minor to moderate. Discretionary actions designed to limit mining are minimal, outside of a withdrawal of public lands from the mining laws.

DLMP/DEIS Alternatives: Alternatives A and D would continue recognition for the Horse Range Mesa paleontological site with a NSO stipulation for oil and gas leasing. Potential formations would not require site-specific inventories for fossil resources under Alternatives A and D. Under Alternatives B and C, site-specific paleontological surveys would provide for site avoidance of potential fossil-yielding formations with regard to most disturbance activities (other than locatable mineral development on less than 5 acres, where a plan of development would not be required).

Impacts Related to Vegetation and Fire and Fuels Management

Under all of the alternatives, minimal vegetation treatment is proposed where the potential exists for paleontological resources. There may be few, if any, negligible impacts to paleontological resources from vegetation and fire and fuels management.

WFU and prescribed burns would continue, and may result in direct and indirect impacts to paleontological resources. Fire may result in the direct destruction of organic fossil remains (e.g., Quaternary packrat middens). The removal of vegetative cover by fire may accelerate erosion and aeolian processes, which may, in turn, result in short-term indirect impacts. However, these impacts may be negligible when compared with similar impacts that occur by natural processes. Fire suppression that involves the use of heavy equipment and the construction of firelines would create surface disturbances that may result in direct minor impacts to paleontological resources.

DLMP/DEIS Alternatives: Under all of the alternatives, the potential impacts related to fire and fuels management on paleontological resources may be similar. Under Alternatives B and C, site-specific paleontological surveys would provide for site avoidance of potential fossil-yielding formations related to most disturbance activities. Without the requirement for site surveys for fossil information outcrops, negligible impacts to potential fossil-bearing formations may occur under Alternatives A and D.

Impacts Related to Recreation

Under all of the alternatives, recreation would maintain an emphasis on opportunities associated with motorized vehicle use (including exploring backcountry roads, vehicle camping, sightseeing, and picnicking). Management of the Dolores Canyon Special Management Area may would continue to provide protection to paleontological resources under all of the alternatives; therefore, direct and indirect impacts may be minor. Increased visitation under current management may increase surface disturbance and opportunities to directly and indirectly damage resources, to the extent that minor impacts may occur to the paleontological resources. **DLMP/DEIS Alternatives:** The potential impacts related to recreation on paleontological resources may be similar under all of the alternatives. Under Alternatives B and C, site-specific paleontological surveys would provide for site avoidance of potential fossil-yielding formations under developed recreation sites. Casual recreational collecting would continue under all of the alternatives.

Impacts Related to Lands and Realty Management

Lands and realty actions may acquire surface and subsurface estate, which would bring the estate under Federal protection, and, thereby, benefit paleontological resources.

Land disposals have the potential to remove paleontological resources from Federal jurisdiction. Withdrawals restrict certain activities (including access), which, in turn, decreases visitation. This may indirectly benefit paleontological resources (because fewer visitors may result in less surface disturbance, as well as in fewer opportunities to impact resources). The impacts would be minor.

Surface-disturbing activities authorized by the lands and realty programs (including ROWs and communication sites) may result in adverse direct and indirect impacts to paleontological resources. The impacts may be minor to moderate. Impacts from lands activities may be expected to be minor under all of the alternatives.

DLMP/DEIS Alternatives: The potential impacts related to lands actions on paleontological resources may be similar under all of the alternatives. Under Alternatives B and C, site-specific paleontological surveys would provide for site avoidance of potential fossil-yielding formations, thereby providing a means to identify and avoid disturbance to fossil sites. Without the requirement for site surveys for fossil formation outcrops, negligible impacts to potential fossil-bearing formations may occur under Alternatives A and D.

Impacts Related to Trails and Travel Management

The most miles of roads would be open to motorized and mechanized travel under Alternative A. The Slick Rock mining district has no road or OHV restrictions under Alternative A. The greatest potential for impacts to paleontological resources associated with motorized and mechanized travel along roads may, therefore, occur under Alternative A. Overall impacts to paleontological resources may be long-term and minor.

Historically, mining, oil, and gas activity, as well as visitors, have all created roads. Their repeated use has made them permanent. These unapproved roads may be destructive to paleontological resources. Alternative A would propose little development of new permanent roads within the planning area, thereby protecting paleontological resources from further damage.

Under Alternative B, fewer miles of routes within the planning area would be open to motorized use (significantly less than the miles and area open to motorized use under current management). In addition, there would be no designation of open off-highway use.

Under Alternative C, significantly fewer miles of routes would remain open for motorized and mechanized use by the public than under current management. Alternative C may would be the most restrictive for motorized/mechanized access and, consequently, may be the most successful alternative at reducing visitor-caused surface disturbances to paleontological resources from motorized use. Impacts may be similar to those discussed under Alternative B, but less intense.

Under Alternative D, nearly as many miles of routes would remain open to motorized and mechanized use as would remain open under Alternative A. Overall, Alternative D would be the least restrictive alternative, in terms of OHV-use, and may, therefore, result in more localized impacts from such use than that which may occur under the other alternatives. In addition, opportunities for motorized and mechanized vehicle impacts may be greater, when compared to Alternatives B and C.

Overall, direct and indirect impacts to paleontological resources may be negligible to minor and long-term.

DLMP/DEIS Alternatives: Alternative B and C may result in the greatest potential benefits to paleontological resources. This would be due to protective special area designations. Under Alternatives B and C, site-specific paleontological surveys would provide for site avoidance of potential fossil yielding formations, thereby providing a means to identify and avoid disturbance to fossil sites. Without the requirement for site surveys for fossil formation outcrops, negligible impacts to potential fossil-bearing formations may occur under Alternatives A and D.

Impacts Related to Special Designation Area Management

Current management of the Mud Springs/Remnant Anasazi ACEC, Weminuche Wilderness Area, and potential WSRs and WSAs provide a level of protection with regard to paleontological resources. The Horse Range paleontological site has provided for paleontology research and recovery of scientifically valuable specimens. Alternatives B and C would propose the designation of the Big Gypsum ACEC in order to protect critical resources, thereby providing protection to paleontological resources. These alternatives would require a plan of operations for mineral development and would not permit cross-country motorized travel. Impacts to paleontological resources may, therefore, be minor. Wilderness Area recommendations and WSR suitability management may also provide additional protection for paleontological resources.

Alternative D would propose no acreage for ACEC designation, thereby providing less protection to paleontological resources, when compared to the other alternatives. Impacts may be minor. Mining activities for uranium and vanadium on less than 5 acres would not require a plan of development in any areas with potential for vertebrate fossils, thereby increasing the risk of disturbance to unidentified sites.

DLMP/DEIS Alternatives: Alternative C may result in the greatest potential benefits to paleontological resources (due to protective special area designations), followed by Alternatives B. Alternative A would continue protection of the Horse Range paleontological area. Without the requirement for site surveys for fossil formation outcrops, negligible impacts to potential fossil-bearing formations may occur under Alternatives A and D.

CUMULATIVE IMPACTS

There may continue to be impacts to paleontological resources associated with unauthorized activities within the planning area (including OHV-use, dispersed recreation, grazing, and vandalism). Unauthorized activities, dispersed activities, and natural processes may also result in unmitigated impacts to paleontological resources. Increased uranium and vanadium mining may increase the potential to disturb vertebrate fossils in the Morrison Formation.

APPENDIX Y – PALEONTOLOGICAL
RESOURCES

GEOLOGIC FORMATIONS CONTAINING SIGNIFICANT VERTEBRATE, INVERTEBRATE AND PLANT FOSSILS IN THE PLANNING AREA

Major Geologic Units	Probable Fossil Yield Classification (PFYQ) 1	Known Fossil Resources
Quaternary ² Alluvium		Shrub Ox
San Jose Formation ^{2 3}		Diverse early Eocene vertebrate fossils along the eastern margin of the SJB
Nacimiento Formation ²		Brachiopods; fish, crocodiles, turtles, various mammals, and temperate flora in central SJB, outside planning area
Animas Formation ^{2 3 4}	3	59 species of fossil plants, consisting of 3 ferns, 1 palm, 55 dicots; various vertebrates including Triceratops, Discoscaphites, and Sphenodiscus; abundant petrified wood; typical late-Paleocene mammalian fossils
Kirtland Shale ^{2 4}	5	Baculites; various vertebrates, invertebrates, and plants in western SJB
Fruitland Formation ^{2 4}	5	Baculites, vertebrates including dinosaurs; various vertebrates, invertebrates, and plants in western SJB
Pictured Cliffs Sandstone ^{2 4}	5	Ammonites, cephalopods, baculites, ophiomorpha burrows, palm fronds, leaf impressions, petrified and carbonized palm wood
Navajo Sandstone ⁴	3	Vertebrate and invertebrate tracks and traces
Chinle ^{3 4}	5	Vertebrate (fish) and Plants
Cutler ³		Vertebrate
Lewis Shale ²		Ammonites, baculites, partial skeleton of a mosasaur, Exiteloceras
Dolores Formation ^{3 4}	3	Flowering Plants
Mancos Shale ^{3 4}	2-3	Invertebrates (ammonites, oysters, brachiopods, clams, crayfish burrows), sharks, large marine reptiles, fish, dinosaurs, pollen, plants
Mesaverde Group,	3	Theropod dinosaur tracks, baculites, scaphites, Plants, dinosaurs, mammals, crocodilians, turtles, snails,

¹ Probable Fossil Yield Classification - (PFYQ) Developed by the Paleontology Center of Excellence and the R-2 Paleo Initiative, 1996. accessed 1/2007 <http://fsweb.wo.fs.fed.us/mgm/fspaleoclassification.htm>

² Adapted from: BLM et al. 2000, Carroll et al. 1999, Kues and Lucas 1987.

³ BLM Colorado Oil and Gas Leasing Draft Environmental Impact Statement. April, 1990.

⁴ Working Preliminary Draft West Wide Energy Corridor PEIS D-1 January 2007 & APPENDIX D: POTENTIAL FOSSIL YIELD CLASSIFICATIONS (PFYC) FOR GEOLOGIC FORMATIONS INTERSECTING PROPOSED CORRIDORS UNDER ALTERNATIVES 2 AND 3 (BY STATE)

undivided 2 3 4		oysters
Burro Canyon 3 4	3	plant and invertebrate,
Dakota Sandstone 3 4	5	Plant, dinosaur bones and tracks
Morrison Formation Brushy Basin Member Salt Wash Member 2 3 4	5	Dinosaurs, lizards, other reptiles, birds, mammals, amphibians, fish, invertebrates, plants
Cliff House Sandstone 2 4	5	Ammonites, crustaceans, clams, oysters, snails, starfish, sea urchins, shark teeth, amphibians, turtles, mosasaur, plesiosaur
Menefee Formation 2 4	5	Leaf impressions, palm fronds, conifers, reptile bones, fossil tree trunk
Point Lookout Sandstone 2 4	5	Worms, crustaceans, clams, ammonites, various animal tracks, driftwood

DESCRIPTION OF MAJOR FOSSIL-BEARING GEOLOGY FORMATIONS IN THE SAN JUAN PLANNING AREA

Dakota sandstone (Upper Cretaceous)

The Dakota sandstone consists of dominantly yellowish-brown to gray, quartzitic sandstone and conglomerate with subordinate thin, lenticular beds of gray claystone, impure coal, carbonaceous papery shale, and gray, friable, carbonaceous sandstone. Depositional environments are marine near the top and fluvial near the base. The Dakota sandstone and its fossils characterize the beach and nearshore sands associated with the initial stage of the encroaching Cretaceous epicontinental seaway.

Dinosaur tracks, *Tempskya* wood, wood impressions, coals, and invertebrate traces are the types of fossils known to be present in the Dakota sandstone.

Burro Canyon Formation (Lower Cretaceous)

The Burro Canyon Formation is composed of light-gray and light-brown, fluvial, quartzose sandstone and conglomerate in thick beds with lenticular, greenish-gray, locally purplish, siltstone, shale, and mudstone. The Burro Canyon Formation is a continuation of the basin fill atop the Morrison Formation, but with sediments derived from Sevier highlands in central Utah (Aubrey 1992).

Dinosaur bones and tracks, limonitic wood, seed pod, and leaf impressions are known in areas of the Four Corners region.

Morrison Formation (Upper Jurassic)

Dominantly fluvial, subordinately lacustrine, sandstone and mudstone alluvial deposits make up the Morrison formation. The Morrison Formation is a vast shallow-basin deposit that extends across nine western states. In the Four Corners region, the Morrison records the deposition of detritus derived from Jurassic Mogollan highlands of central Arizona. The coarser-grained lower members of the Morrison preserve remains of large river deposits with associated floodplain and shallow ponds and lakes. The Morrison Formation of the western U.S. is famous for its dinosaur fossils. Gymnosperm fossils are also known to occur. All of the four members of the Morrison formation are fossiliferous. The Brushy Basin member has been studied by Brigham Young University at a location on Horse Range Mesa site which contains dinosaur fossils.

The Brushy Basin member consists of variegated bentonitic lacustrine mudstone with a few lenses of chert-pebble conglomeratic sandstone, some of which contain uranium-vanadium deposits. Significant fossils include carnivorous dinosaurs like *Allosaurus*, sauropod dinosaurs including *Camarasaurus*, gastroliths (stomach stones), and petrified wood including *Hermanophyton* and *Xenoxylon*.

The Brushy Basin member and remaining members of the Morrison Formation generally contain dinosaur bones, petrified wood, and plant fossils in the Four Corners region.

Junction Creek sandstone (Upper Jurassic)

Pink or reddish-orange fine- to coarse-grained, poorly sorted eolian crossbedded sandstones make up the Junction Creek Sandstone. The Junction Creek sandstone, and the fossils it bears, records the sand dune deposits derived from winds off of the retreating Curtis Sea.

PROBABLE FOSSIL YIELD CLASSIFICATION DESCRIPTIONS - (PFYQ)

Developed by the Paleontology Center of Excellence and the R-2 Paleo Initiative, 1996.

Introduction

This is a planning tool wherein geological units, usually at the formation or member level, are classified according to the probability of yielding paleontological resources that are of concern to land managers. Existing statutes and policies regulate the collection and disposition of vertebrate fossils, but not nonvertebrate fossils except in special circumstances. Therefore, this classification is based largely on how likely a geologic unit is to produce vertebrate fossils of terrestrial (i.e., non-marine) origin. The classes are described below, with some examples of corresponding management considerations or actions. Useful references are the Paleo resources Use and Management Action Spectrum (PUMA), Criteria for Scientific Significance - Specimen, Criteria for Sensitivity Ranking - Locality.

Note: This system is based on *probabilities*, not certainties or special circumstances. There will be exceptions to each criterion used as the basis for classification. These are expected and should be handled as unique cases.

PALEO CLASSES

Class 1

Description: Igneous and metamorphic (ashes are excluded from this category) geologic units that are not likely to contain recognizable fossil remains.

Basis:

- Fossils of any kind known *not* to occur except in the rarest of circumstances.
- Igneous or metamorphic origin.

Example: Vishnu schist

Management examples:

- Paleo acres not weighted the Geology Resource Base Acres budget allocation criterion.
- No Class 1 paleo acres included in Geology Management Acres budget allocation criterion.
- Acres with this classification not included in paleontological reconnaissance work plans.

The land manager's concern for paleo resources on Class 1 acres is negligible. Ground-disturbing activities will not require mitigation except in rare circumstances. Plans do not need to address the range of potential uses or management options described in the

Paleo resources Use and Management Action Spectrum (PUMAS). Budgets do not need to allocate dollars for paleo-weighted geology acres. Much of the acreage of high altitude, mountainous districts will be determined Class 1.

Class 2

Description: Sedimentary geologic units that are not likely to contain vertebrate fossils nor scientifically significant nonvertebrate fossils.

Basis:

- Vertebrate fossils known to occur *very rarely or not at all*.
- Age greater than Devonian.
- Age younger than 10,000 years before present.
- Deep marine origin.
- Aeolian origin.
- Diagenetic alteration.

Example: Mancos shale

Management examples:

- Paleo acres not weighted in the Geology Resource Base Acres budget allocation criterion.
- Paleo acres *generally not* included in Geology Management Acres, but rare exceptions are likely to be scientifically significant and require some management prescription.
- Class 2 Paleo *generally not* included in paleontological reconnaissance work plans. There may be rare exceptions.

The land manager's concern for paleo resources on Class 2 acres is low. Ground-disturbing activities are not likely to require mitigation. Management alternatives should tend toward the middle of the PUMA (high access--low management), in all but exceptional cases. Recreational fee-based or user-based opportunities unlikely.

Class 3

Description: Fossiliferous, sedimentary geologic units whose fossil content varies in significance, abundance, and predictable occurrence. Also sedimentary units of unknown fossil potential.

Basis:

- Primarily marine origin with sporadic known occurrences of vertebrate fossils (other than fish scales and shark teeth).
- Vertebrate fossils and significant nonvertebrate fossils known to occur inconsistently-- predictability known to be low.
- Poorly studied and/or poorly documented-potential yield cannot be assigned without ground reconnaissance.

Example: Chinle formation

Management examples:

1. Some Class 3 paleo acres may *be* weighted in the Geology Resource Base Acres budget allocation criterion.
2. Some Class 3 paleo acres may *be* included in Geology Management Acres budget allocation criterion and reported in MAR:
 - Opportunity areas - see below
 - Highly sensitive areas needing special protection (see Criteria for Sensitivity Ranking - Locality).
 - Areas actively being researched
3. Acres with this classification may *be* included in paleontological reconnaissance work plans, if this designation is made on the basis of criterion 3 above.
4. Fee -based and/or user based recreational opportunities possible.

The land manager's concern for paleo resources on Class 3 acres may extend across the entire PUMAS, with some areas requiring very little budget and management and providing high levels of unregulated access, while other areas may require annual budget allocations for intense management. Ground-disturbing activities will require sufficient mitigation to determine whether significant paleo resources occur in the area of a proposed action. Mitigation beyond initial findings will range from no further mitigation necessary to full and continuous monitoring of significant localities during the action. Recreational opportunities should be identified where appropriate and utilized under recreation fee authorities to produce revenues that can be applied to paleoresource management.

Class 4

Description: Class 4 geologic units are Class 5 units (see below) that have lowered risks of human-caused adverse impacts- and/or lowered risk of natural degradation.

Basis:

- Significant vegetative cover; outcrop is not exposed.
- Areas of exposed outcrop are smaller than two contiguous acres
- Outcrop forms cliffs of sufficient height that most is out of reach by normal means.
- Other characteristics that lower the sensitivity of both known and unidentified fossil sites (see Criteria for Sensitivity Ranking - Locality).

Example: Covered acres of Morrison Fm.

Management examples:

1. Class 4 paleo acres *are* weighted in the Geology Resource Base Acres budget allocation criterion.
2. Some Class 4 paleo acres may *be* included in Geology Management Acres budget allocation criterion and reported in MAR:
 - Opportunity areas - see below
 - Highly sensitive areas needing special protection (see Criteria for Sensitivity Ranking - Locality)
 - Areas actively being researched
 - Paleo reports likely to be counted in Geology Reports MAR (permits, agreements, contracts, etc.)
 - Acres with this classification *should be* included in paleontological reconnaissance work.
 - Scientific and educational use likely. Paleo special use permits and challenge cost-share agreements likely.
 - Ongoing curation agreements with regional accredited museums recommended.
3. Fee-based and/or user-based recreational opportunities most likely.

The land manager's concern for paleo resources on Class 4 acres is toward management and away from unregulated access. Ground-disturbing activities will require mitigation to determine whether significant paleo resources occur in the area of a proposed action. Mitigation beyond initial findings will range from no further mitigation necessary to full and continuous monitoring of significant localities during the action. Class 4 paleo acres are the most *likely to* yield appropriate recreational opportunities. These should be identified and optimized under recreation fee authorities. Class 4 paleo acres are the most likely to generate revenues that can be applied to managing highly sensitive Class 5 paleo resources.

Class 5

Description: Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant nonvertebrate fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.

Basis:

- Vertebrate fossils and/or scientifically significant nonvertebrate fossils are *known and documented to* occur consistently, predictably, and/or abundantly.
- Outcrop is exposed; little or no vegetative cover.
- Extensive exposed outcrop; discontinuous areas are larger than 2 contiguous acres.
- Outcrop erodes easily, may form badlands.
- Easy access to extensive outcrop in remote areas (increased potential for illegal collection; vandalism).
- Other characteristics that increase the sensitivity of both known and unidentified fossil sites (see Criteria for Sensitivity Ranking - Locality).

Example: White River formation/group

Management examples:

1. Class 5 paleo acres *are* weighted in the Geology Resource Base Acres budget allocation criterion.
2. Some Class 5 paleo acres *may be* included in Geology Management Acres budget allocation criterion and reported in MAR:
 - Opportunity areas - see below
 - Highly sensitive areas needing special protection (see Criteria for Sensitivity Ranking--Locality)

- Areas actively being researched
- Paleo reports likely to be counted in Geology Reports MAR (permits, agreements, contracts, etc.)
- Paleontological reconnaissance work should focus only on poorly known areas of Class 5 acres because they are already considered a management priority.
- Scientific and education use highly likely. Highest number of paleo special use permits expected for Class 5 acres. Challenge Cost Share agreements with a broad spectrum of professional and avocational paleontologists expected.

3. Fee-based and/or user-based recreational opportunities possible.

Ongoing curation agreements with regional accredited museums recommended.

The land manager's highest concern for paleo resources should focus on Class 5 acres. These areas are likely to be poached. Mitigation of ground-disturbing activities is required and may be intense. Frequent use by the full range of interested publics is to be expected. Areas of special interest and concern should be designated and intensely managed. Field-based, technical training in paleoresource management should be provided to Forest and district staff and to law enforcement officers. Memoranda of understanding, challenge cost-share, and/or participating agreements with professional academic paleontologists should be sought and maintained in order to provide a consistent source of outside expertise. Curation agreements should be maintained with area museums so that there is always a repository for fossils collected and turned over to the Forest. Class 5 paleo acres are likely to yield appropriate recreational opportunities, though it is more difficult to isolate opportunity acres from surrounding critical acres and therefore access must be more intensely regulated. These should be identified and utilized under recreation fee authorities, but the delicate balance between opportunity and potential degradation of critical Class 5 Paleo resources must be recognized and addressed in planning for such use.

LOCALITY/SITE SENSITIVITY RANKINGS FOR FOSSIL RESOURCES

Paleontological sensitivity rankings are composite evaluations derived from individual consideration of the following factors. Sensitivity rankings apply to paleontological sites and localities, not to individual specimens.

1. *Scientific significance* of specimens associated with the site.
2. *Probability of yield* based on likelihood that geologic strata at the site are fossiliferous. This factor may be evaluated by direct reconnaissance or by consulting the pertinent literature; preferably both methods will be employed.
3. *Values* of an educational, interpretive, or recreational nature.

Public education, interpretive, and recreational values are those that utilize the power of fossil resources to provoke insight into ancient life ways and ancient ecology, and to reveal their connections to the present and future. Educational values also enhance a stewardship ethic towards legacy resources, and stress the importance of environmental and scientific literacy.

4. *Risk* of resource degradation at the site.

Risk factors include:

- Biotic agents: Vandalism, theft, destruction; grazing impact; trail-use impact.
- Abiotic agents: Chemical and mechanical destruction of fossils exposed by erosion; landslides; inundation; fluvial transport; etc.

Each factor above should be ranked individually on a scale of 1 to 5, where 1 is the lowest sensitivity ranking and 5 the highest. The composite ranking of sensitivity for a locality or site is the arithmetic mean of the individual rankings.

Example 1

A "category: vertebrate" site is identified in rocks of the Orellan Land Mammal "Age" on the Pawnee National Grassland.

Scientific significance ranking = 5.

See Scientific significance criteria below. Specimen-based criterion 3 is met. Criteria 1, 2, and 3 are likely to be met by many specimens in this geologic formation. Context-based criterion 2 is met--the mammalian fauna of the Pawnee NG is critically important for constraining age correlations in the Orellan.

Probability of yield ranking = 4.

The formation is known to be fossiliferous. Mammal fossils are likely to be found following erosional events.

Values ranking = 4.

The mammalian fauna of the Orellan in the Western Interior is informative to questions of paleoecology and biogeography. Interpretive materials that utilize this paleontological resource would be good examples of the way scientists interpret ancient ecosystems, and how that information can be applied to modern-day problems of global change.

Risk factor ranking = 5.

Biotic agents: Significant and sensitive sites are located near or on trails. These trails are advertised in area guides as "good places to pick up fossils."

Abiotic agents: Sites are located in geologic strata that erode very easily and rapidly, especially during the spring and early summer. Fossils may be easily washed out of their informative context, or removed altogether and re-buried downstream by ephemeral flows.

Composite ranking: $5 + 4 + 4 + 5 = 18$; divide by 4 = 4.5 sensitivity ranking for this site.

Appropriate management strategies for this site would include designation as a Research Natural Area. Allowable activities on an opportunity spectrum would include research by qualified investigators, technical educational field work by non-specialists overseen by qualified technicians, guided interpretive tours for the public.

Example 2

A "category vertebrate site" is identified in Cretaceous marine rocks on the Buffalo Gap National Grasslands.

Scientific significance ranking = 1.

The only identified fossils at and near the site are shark teeth and an occasional fish vertebra.

Probability of yield ranking = 5.

Shark teeth are exceedingly abundant, and in places form a deflation surface.

Values ranking = 2.

The recreational public is likely to enjoy picking up shark teeth in this area, and to consider the past environment in which they were deposited – without interpretive aids. The area does not lend itself to formal interpretive displays or activities.

Risk factor ranking = 2.

Biotic agents: The likelihood that sufficient collecting by the general public will deplete the supply of shark teeth is low for the foreseeable future; however, the possibility that other, more significant fossils will be found and carried away exists and cannot be easily monitored. The area is heavily grazed, but the fossils are fairly evenly distributed on the landscape, so areas where cattle do not congregate are fairly free of impact.

Abiotic agents: The outcrop area is low, flat-lying, and heavily vegetated, so the chances that erosion, landslides, floods, or flash floods will threaten the fossil resource is low.

Composite ranking = $1 + 5 + 3 + 2 = 10$; divide by 4 = 2.5 sensitivity ranking for this site.

Appropriate management strategies for this site would be: No permit required for picking up shark teeth; mention in a Forest/district brochure on paleontological resources as an educational and interpretive tool to promote understanding of represented ancient environment; request that the public report any unusual fossil finds; occasional reconnaissance to determine if collecting of shark teeth is threatening other resources in the area or affecting the scenic and aesthetic values of the site.

SCIENTIFIC SIGNIFICANCE CRITERIA FOR FOSSIL RESOURCES

(drafted by the Paleontology Advisory Group July 2000)

Scientific significance may be attributed to a fossil specimen or trace, and/or to its context (e.g., location in time and space; association with other relevant evidence; or association with cultural resources).

The scientific significance of a paleontological specimen or trace, and/or its context is determined by meeting any one of the following criteria:

- **Specimen-based criteria:**
 - Represents an unknown or undescribed/unnamed taxon.
 - Represents a rare taxon, or rare morphological/ anatomical element or feature. The "rareness" criterion comprises either absolute rareness in the fossil record, or relative or contextual rareness as described below.
 - Represents a vertebrate taxon.
 - Exhibits an exceptional type and/or quality of preservation.
 - Exhibits remarkable or anomalous morphological/anatomical character(s) or taphonomic alteration.
 - Represents "soft tissue" preservation or presence.
 - Exhibits cultural affiliation, e.g., alteration or use by ancient man.
- **Context-based criteria:**
 - Is associated in a relevant way with other evidence of scientific interest, providing taphonomic, ecologic, environmental, behavioral, cultural or evolutionary information.
 - Is evidence that extends and/or constrains the stratigraphic, chronologic and/or geographic range of a taxon or functional paraphyletic group.

PALEONTOLOGICAL SURVEY PROCESS

Once a ground-disturbing project is identified to take place and during the NEPA process, a series of steps is taken to determine if paleontological resources will be impacted and what process will be needed for mitigation:

Step 1. Determine if the area to be disturbed will impact paleontological resources:

- Each unit will determine if the project area contains fossils by consulting the maps delineating the geologic formation classifications.
- If the formation is Class 1, fossils are not likely to be discovered; document in NEPA project file.
- If the formation is Class 2, significant fossils are not likely to be discovered; notify the Forest Service Paleontologist and proceed with Step 2.
- If the formation is Class 3-5, significant fossils will likely be discovered; notify the Forest Service paleontologist and proceed with Steps 2-5.

Step 2. The Forest Service paleontologist will conduct a literature search of paleontological information for the project area, including material that may be contained in permitting documents, scientific literature, geological maps, libraries, and museums. This information will become part of the NEPA project file. Surveying will not be required when no scientifically important specimens or sites are discovered in the literature. Go to Step 3 if the literature review indicates scientifically important fossils may be impacted.

Step 3. Forest Service paleontologist and/or qualified consultant will conduct a pedestrian survey of proposed project area and document findings. If paleontological sites are discovered then go to Step 4. If survey reveals no surface indication of fossils, then document in the NEPA project file.

Step 4. The Forest Service paleontologist or qualified consultant will determine the sensitivity ranking for the sites to be impacted. (A Class 5 geologic formation may contain sites of low sensitivity.) The paleontologist on site will have to make this determination based on professional judgement and according to the process outlined in the sensitivity ranking.

Step 5. In sites with Class 3, 4, or 5 and a high sensitivity ranking, a Forest Service paleontologist shall develop a protection and mitigation plan prior to project initiation and periodically monitor for compliance with the mitigation plan throughout the project

Note: Units with formations ranked as Classes 3-5 should have repository agreements in place with agencies or institutions collecting fossils as part of mitigation in order for the fossils to be cared for in perpetuity.