

The effects of development on the Sulphur and Redfeather Ranger Districts are eliminated in Alternative H, as none of the analysis area would be leased.

On the Grassland, all alternatives contain the timing limitation to protect the shortgrass prairie nesting habitat of the mountain plover (*Charadrius montanus*), a bird that may soon be listed as threatened or endangered. This requirement was determined in the Mountain Plover Management Strategy EIS and ROD completed in March 1994, and applies to all areas with surface occupancy. Drilling, production facility construction, and plugging and abandonment of wells are prohibited from April 10 to July 10 to protect nesting habitat.

Avoidance of common range improvements (windmills, etc.) and slopes greater than 60 percent can be accomplished by applying the mitigation measure of moving development 200 meters. The effects of these requirements on the industry are minimal, but may result in delays of development.

NSO is applied to the dispersed recreation management areas in Alternative E, prairie woodlands, the Pawnee Pioneer Trails Scenic Byway, and Research Natural Areas (RNAs) in all Alternatives except H. Alternative H applies the most NSO to 56 percent of the Grassland to protect and maintain biodiversity. Alternative H would not lease proposed RNAs. Alternative B uses NSO to protect the RNAs, the West Stoneham Archaeological District scenic byway, and prairie woodlands. Alternative E protects the scenic byway, RNAs, and dispersed recreation areas. Alternatives A uses NSO for the Pawnee Buttes area, the byway, prairie woodlands, and the existing Daves Draw RNA. Alternative I uses NSO for the Pawnee Buttes, Crow Valley, Daves Draw and the scenic byway. Alternative C uses the least NSO for the byway and RNAs.

The Pawnee Buttes area, 2,740 acres, would not be leased in Alternatives B, C, E, and H because of its unique scenic, vegetation, wildlife, geology, paleontological, and recreational values. The Crow Valley Recreation Area would not be leased in Alternatives A, B, C, and E, and totals 240 acres.

The effects of no-lease areas on the industry would be lost opportunities to develop the mineral resource and associated economic impacts. No Surface Occupancy would still allow the potential of either directional drilling from adjacent federal or private surface or allow lands to be included with other developed oil and gas production, when that development results in drainage of federal oil and gas.

The private mineral estates under the 58,113 acres of the Grassland, (30 percent) are not bound by the NSO stipulation, but the Forest Service would try to negotiate appropriate mitigation measures with the operator for surface resource protection.

Leasing of the 21,522 acres of private surface with federal minerals parcels within the administrative boundary of the Grassland is most affected by the timing limitation for the mountain plover. Leases are issued on these parcels by the BLM with Forest Service input when the Grassland and its resources may be affected. Lease proposals are considered on a case-by-case basis, as the surface may be wheat fields, abandoned croplands, or prairie available

to the mountain plover for nesting. Potential impacts from spills on private lands that drain onto the Grassland are also considered.

Effects on Oil and Gas Development from Heritage and Paleontological Resources Management

Heritage resources are protected by various laws, policies, and regulations. Before any ground-disturbing activities can occur on the Forest or Grassland, a heritage resource survey must be completed. Roads, wellsites, pipelines, production facilities, and other disturbed areas must be surveyed. Potentially significant sites must be avoided or evaluated.

Paleontological resources will be identified at the leasing decision or validation and a lease notice added, or when site-specific onsite reviews are held. The site will be evaluated or avoided by the development.

SALABLE MINERALS

Disposal of gravel, sand, clay, and other mineral materials is by special-use authorization at the discretion of the Forest Service. As of July 1997, no permits for the minerals had been authorized for the Forest or Grassland. Proposals may be submitted and approved by the Forest Service after the appropriate environmental analysis and decision documentation if such use is compatible with the direction for the management area and other surface concerns. The possible disturbed area is predicted at five acres on the Forest and five acres on the Grassland for the life of the *Forest Plan*.

CUMULATIVE EFFECTS FOR MINERAL ACTIVITIES

LOCATABLE MINERALS

Existing surface disturbance due to locatable mineral activities is 20 acres, with an additional 20 acres expected for the life of the *Forest Plan*. This total represents .005 percent of the portion of the Forests that is not withdrawn from mineral entry.

LEASABLE MINERALS

As of May 1997, there were 46 producing wells and 15 abandoned sites undergoing reclamation on the Grassland that have effects that must be considered in the RFD. At this time, the existing disturbed surface area is:

Table 3.37 Existing Development, PNG, 1997

Development	Number	Acres Disturbed
Production Facilities	27	14
Wellheads	45	23
Associated Roads	23 miles	65
Abandoned Sites	15	45
TOTAL		121

The road system in the Lilli field, a major development with 61 wells (32 of them on the Grassland), results in 10 acres more disturbance than shown in the analysis assumptions for development of 32 wells. The fields predicted in the RFD are five to six well fields, and disturbance by the road system will be less.

Because some abandoned sites and dry holes in reclamation have revegetated or the area actually disturbed was much less than the total area inside the fence, the total disturbed area for those sites is much less than the 45 acres shown in Table 3.37.

Because pipelines are often located in roads or revegetate quickly when located on the prairie, they are not considered disturbed areas. The production facilities and wellheads included in the table are considered to have satisfactory interim revegetation of larger areas disturbed by drilling but not needed for production.

The additional activity forecast in the RFD would result in additional ground disturbance on the Sulphur and Redfeather Districts and the Grassland, as described in Tables 3.33 and 3.34. Since the Sulphur and Redfeather Ranger Districts have no current development, surface disturbance of 137 acres in Alternatives A, B, C, E, and I, is considered cumulatively with other resource managements. Alternative H would not lease the analysis area in the mountain districts.

The RFD activities for the alternatives are shown in Tables 3.30 and 3.31.

The number of wells and surface-disturbed acreage for Alternatives A, B, C, E, and I for the life of the *Plan* are shown below. Assumptions are that half of the RFD will be accomplished in five years, and all of the RFD will be completed in ten years and that one existing producing well will be plugged and abandoned annually and reclaimed in three to five years. It is also assumed that the Lilli field will still be in production.

Table 3.38 Acres Disturbed in Alternatives A, B, C, E, I, PNG, 1997-2005

Year	Producing Wells	Abandoned Sites	Acres Disturbed
1997 (existing)	46	15	121
2001	46	13	115
2007	46	12	111

The acres disturbed represent .0006 of the Grassland, or less than one-tenth of one percent, of the total Grassland surface of 192,542 acres.

Table 3.39 Acres Disturbed in Alternative H, PNG, 1997-2005

Year	Producing Wells	Abandoned Sites	Acres Disturbed
1997 (existing)	46	15	121
2002	45	11	105
2007	43	10	99

The acreage disturbed is .0005 to .0006 of the Grassland, or less than one-tenth of 1 percent.

Table 3.40 Acres Disturbed in Alternatives A, B, C, E, I, ARNF, 1997-2007

Year	Producing Wells	Abandoned Sites	Acres Disturbed
1997 (existing)	0	0	0
2002	4	2	82
2007	7	1	110

The acres disturbed on the Sulphur and Redfeather Districts is .001, or one-tenth of 1 percent of the analysis area.

The private surface with federal minerals parcels managed by the BLM has an RFD of three dry hole and two producing wells over the next ten years. If one of the existing 30 such wells within the administrative boundary is abandoned annually, the number of wells will decrease to 22 by the year 2005. The surface where these wells are located is wheat fields, abandoned croplands, or prairie, and the amount of acres disturbed is considered to be minimal.

SALABLE MINERALS

No development for these materials is currently occurring on the Forest or Grassland. Five acres of surface disturbance may occur on the Forest and five acres on the Grassland for the life of the *Forest Plan*.

SUMMARY OF CUMULATIVE EFFECTS FOR MINERAL DEVELOPMENT

Tables 3.41 and 3.42 display the cumulative acres of surface disturbance on the Forest and Grassland over the life of the *Plan*. Oil and gas development is assumed to occur in the analysis area on the Sulphur and Redfeather Districts, and the locatable and salable activities may occur over the rest of the Forest where authorized. The acres on the Grassland reflect the disturbed areas existing in 1997.

Table 3.41 Cumulative Acres of Surface Disturbance on the Sulphur and Redfeather Ranger Districts from Mineral Activities, ARNF

Mineral Category	Alternative	
	A, B, C, E, I	H
Locatable	40	40
Leasable	137	0
Salable	5	5
Total	182	45
Percent of total Forest acres disturbed, not including withdrawn acres	.02	.006

Table 3.42 Cumulative Acres of Surface Disturbance on the Pawnee National Grassland from Minerals Activities

Mineral Category	Alternative	
	A, B, C, E, I	H
Locatable	0	0
Leasable	121-111	121-99
Salable	5	5

Mineral Category	Alternative	
	A, B, C, E, I	H
Total	126-116	126-104
Percent of total grassland acres disturbed	.07-.06	.07-.05

The potentially disturbed acreages are less than one-tenth of one percent of the area analyzed. Note that this activity would not occur at one time, so the acreage affected at one time would probably be less over the life of the *Forest Plan*.

HERITAGE RESOURCES

Abstract: Heritage resources, formerly known as cultural resources, are the physical remains of past human lifeways on the Forests and Grassland. Prehistoric artifacts such as projectile points, sites such as stone circles, and physical remains from historic-period activities such as homesteading, mining, railroads, recreation, and other legendary and real events are examples.

Approximately 79,400 (5 percent) of the 1,481,786 acre Forests and Grassland have been inventoried, and 468 prehistoric sites and 243 historic sites found as of January 1995. Of these 711 sites, 102 appear to be eligible for the National Register of Historic Places (NRHP). Seven properties are currently listed.

If any activity planned under a federal permit or federal funding might impact the characteristics of a site eligible for the NRHP, it must be evaluated for heritage purposes prior to implementation. All alternatives have the potential to affect heritage resources. The number of sites that could be found over the life of the *Forest Plan* is approximately 1,531, of which 213 will probably be eligible for the NRHP.

Available evidence suggests, furthermore, that the Forests and Grassland may contain as many as 10,648 individual heritage sites, with 14 percent, or 1,479 properties, eventually qualifying for the NRHP.

INTRODUCTION

Heritage resources, formerly known as cultural resources, represent the physical remains of past human lifeways and activities on the Forests and Grassland. A lifeway is defined as the way humans interact and survive within an ecosystem. Prehistoric representations may include artifacts and sites such as projectile points, rock shelters, stone circles, and other manifestations of aboriginal lifestyles spanning the last 12,000 years. Historic-period representations may include wagon trails, homesteading, mining, railroading, Civilian Conservation Corps camps and developments, or other real or legendary events. Heritage resources are nonrenewable. Once sites are disturbed or artifacts are removed from their natural settings, information about our heritage that can be learned not only from the artifact, but also from the context of its location, is forever lost. In general, heritage resources are 50 years or older, and include past Forest Service activities as well as those preceding the establishment of the National Forest System. Disturbing sites or collecting and removing artifacts such as projectile points and barnwood from federal lands without a permit is prohibited.

The Forest Service seeks to provide a sense of orientation to the American people and to ensure future generations a genuine opportunity to appreciate and experience our nation's rich and diverse heritage. Heritage stewardship and natural resource management must exist in productive harmony to fulfill social, economic, and spiritual needs of the American people. The

National Forests and Grassland offer unique opportunities to protect and interpret the nation's heritage now and in the future. The heritage resources within the National Forest System include both ancient sites and living traditions. The Forest Service manages for a wide diversity of public users and uses, including interpretation for and participation by the general public, conservation and preservation for scientific values and for future generations, and access for Native American traditional practices.

The goals of the heritage resource program are to:

1. provide interpretation to increase public understanding, appreciation, and perspective of our diverse heritage
2. provide opportunities for scientific study to gain knowledge about past human behavior and about past environments relevant to present and future ecosystem management
3. inventory resources and prevent loss or damage until they can be evaluated for significance and appropriate uses
4. nominate significant sites to the NRHP

LEGAL FRAMEWORK

The Forest Service is required to inventory and evaluate all heritage resources on National Forest System lands, and to protect, enhance, and nominate significant resources for the National Register of Historic Places. Section 106 of the *National Historic Preservation Act of 1966*, as amended, requires the Forest Service to determine if federally funded, permitted, or licensed activities would disturb significant heritage resources. The criteria for the Register refer to the quality of significance in American history, architecture, archaeology, and culture. If a resource would be affected, the activity is considered an "undertaking," and the appropriate inventory, evaluation, consultation, and necessary protection are conducted. An undertaking is any project, activity, or program that can result in changes in the character or use of any historic properties located in the area of potential effects (36 CFR 800.2). *The Archaeological Resources Protection Act of 1979*, as amended, requires each federal agency to develop a plan for inventory, survey, and site protection. *The Native American Graves Protection and Repatriation Act of 1990* requires each federal agency to survey and inventory heritage collections for materials related to ceremonial usage. Such items would be repatriated to the appropriate tribe or individual. Each act requires public and/or other agency consultations regarding potential impacts to significant sites.

AFFECTED ENVIRONMENT

Human occupation of the mountains and plains environments on the Forests and Grassland has been continuous for at least the last 11,700 years, and probably longer. Remains of past human lifeways are found throughout the Forests and Grassland. Table 3.43 provides the status of lands inventoried and sites found.

Table 3.43 Heritage Resource Management, ARNF-PNG, January 1995

Activity	Forest	Grassland	Total
Acres Surveyed	58,400	21,000	79,400
Percent of Forest and Grassland Surveyed	5	11	5.4
Prehistoric Properties Identified	118	350	468
Historic Properties Identified	201	42	243
Eligible for Nomination to NRHP	42	60	102
Properties on the NRHP	5	2	7

Five sites have been interpreted for public appreciation and awareness: the Mount Evans Crest House, Homestead Meadows, Moffat Road, West Stoneham Archaeological District, and Arrowhead Lodge. Displays on heritage resource management can be found in the Grassland office in Greeley, the Crow Valley Recreation Area, and the Clear Creek District Office in Idaho Springs. Two brochures are available for the public regarding heritage resources and their management on the Forests and the Grassland. "Passport in Time" and "Windows on the Past" projects are conducted on the Forests and Grassland as well. Several research projects have recently been conducted in the Indian Peaks and Rawah Wildernesses and in the West Stoneham Archaeological district, which has been designated a Special Interest Area in the *Forest Plan*.

FUTURE TRENDS

As use of the Forests and Grassland continues to rise due to the increased local population and nonresident visits, impacts to heritage resources are expected to increase. Unauthorized collecting, theft, excavations, and vandalism occur now and will continue. Natural erosional and depositional processes will also degrade heritage resources. Data collection through excavation, the most common mitigation for unavoidable impacts, also results in some loss of the resource. Inadvertent damage during project implementation also occurs. Finally, some resources are affected when required monitoring or other forms of recommended mitigation are not carried out, resulting in noncompliance with applicable laws and regulations.

As surveys are completed and projects are implemented, additional resources will be located that will require inventory, evaluation, protection, and interpretation. Based on the current number of sites and acres surveyed, an additional 7,044 sites on the Forests and 3,604 sites on the Grassland may exist. This equals about one site for every 183 acres on the Forests' 1,289,050 total acres, and one site for every 54 acres on the Grassland's 192,542 total acres. On the Forests and Grassland combined, 1,479 sites are expected to be eligible for nomination to the Register.

Future management concerns include maintaining compliance with the various laws and regulations on the Forests and Grassland, protecting the sites until they can be evaluated for the Register, and nominating eligible sites to the Register. Additional interpretation, management plans, and protection of important sites are needed. An overview was completed in 1997. Collections with Forest Service items such as Native American religious and ceremonial sites, and their associated grave and ceremonial goods, must be inventoried and summarized. Where appropriate, some artifacts and remains must be repatriated. Consultation with tribal members, the State Historic Preservation Office, and the Advisory Council on Historic Preservation is required to determine management.

Law enforcement is needed to minimize unauthorized collecting, excavations, theft, and other acts of vandalism. Enforcement activities will depend on available resources and funding, but should receive funding at the "experienced" budget level. Nonproject related inventories and activities will require full implementation budget levels.

ENVIRONMENTAL CONSEQUENCES

Because direction for heritage management is detailed by law, regulation, and policy, management in the revision alternatives will not differ, with the exception of the number of inventory surveys and the extent of evaluation, protection of resources, and interpretation opportunities for the public. More interpretation would be expected in Alternatives B and E, with emphasis on providing recreation opportunities; more surveys, evaluation and protection would be required for Alternatives A, C, and I which emphasize activities on the ground. Alternative H limits ground disturbance while emphasizing biodiversity, and inventories and evaluations of sites will be minimized.

RESOURCE PROTECTION MEASURES COMMON TO ALL ALTERNATIVES

A variety of methods is available to eliminate or reduce direct effects on heritage resources. Archaeological excavation or structural recordation can provide for recovery of heritage data. Some activities and projects can be modified to avoid heritage resources. Scheduling projects when the ground is frozen can reduce or eliminate soil compaction and disturbance to avoid damage to resources. Relocating certain features or structures, increasing monitoring and law enforcement, providing interpretation activities and securing restrictive covenants and landownership transfer deeds are other protective measures. The development of scientific archaeological modeling would identify areas of high risk to heritage resources.

Some methods to eliminate, minimize or reduce indirect effects are initiating public education programs, posting heritage resources with informational signs, monitoring sites, properly designing adjacent projects to minimize visual, auditory or atmospheric intrusions, rerouting trails, stabilizing eroding sites, constructing barriers, hiding sites, and undertaking all the mitigation methods listed above for direct effects.

Some methods to eliminate or reduce cumulative effects are recordation, data recovery, interpretation, incorporation of state-of-the-art research techniques, and stabilization or restoration.

DIRECT AND INDIRECT EFFECTS COMMON TO ALL ALTERNATIVES

Direct effects on heritage resources can result from both natural events and from human activities which damage the resources or alter their settings. Ground (subsurface and surface) disturbance, soil compaction, erosion, flooding, soil slumping, heating and freezing, wildfire, prescribed burning, livestock trampling, off-highway vehicle use, alteration of a heritage resource's setting (including introduction of atmospheric, visual, or audible intrusions), and potential loss of protection for undiscovered heritage resources if land is transferred from federal to nonfederal ownership are all potential effects.

Indirect effects can include improved access which brings more visitors and a rise in vandalism, removal of materials, inadvertent damage or fires, and visual and auditory disturbances from adjacent or nearby activities.

Despite inventories, the potential exists for undiscovered sites—especially those that are buried—to be exposed and/or damaged by surface disturbance or other activities. These sites may or may not be noticed in time to allow mitigation. The risk of unavoidable damage is common to all alternatives.

CUMULATIVE EFFECTS

Cumulative effects over time can include loss of sites or parts of sites prior to development of better research techniques, loss of interpretive values, and incremental loss of the heritage resource base. Most of the impacts cited above can or might have longterm cumulative consequences. These include forest management projects that cause surface disturbance, increased public visitation, longterm consequences of nonsanctioned activities such as vandalism and illegal excavation, natural weathering and deterioration, erosion, landslides, fires, and other physical processes. Differences in cumulative effects to heritage resources under different alternatives as a result of sanctioned management activities should be slight because protection and mitigation measures will be common to all. Enforcement of protective measures will also be common to all alternatives and should result in an extremely low level of cumulative effects.

Nonproject-related, proactive heritage resource management will also help to preserve heritage resources. Important known sites are required to be inventoried and evaluated under the Archaeological Protection Act. Areas likely to contain sites should also be examined since heritage resources are important in their own right. They merit careful management planning for inventory, evaluation, nomination, enhancement, protection, and heritage interpretation. Management will be based on the availability of funding and resources, but will receive most emphasis in Alternatives B and E. The “full” implementation budget level would fund these activities.

The total acres that may be inventoried, and the properties found and determined to be eligible for the NRHP by various resource managements on the Forests (Table 3.44) and Grassland (Table 3.45) for the life of the *Plan* are shown below. The survey acres include timber harvests, minerals, prescribed fire, grazing, and recreation management activities. Additional small surveys will result from special-use permits, but were not included in the totals. The actual surveys may be constrained by the lack of funding and resources.

Table 3.44 Existing and Future Project Acres Inventoried on the ANRF, and Sites Found and Determined to be Eligible for the National Register of Historic Places by 2005

Category	Alternatives					
	A	B	C	E	H	I
Acres Currently Inventoried	58,400	58,400	58,400	58,400	58,400	58,400
Future Acres Inventoried	184,864	186,646	174,018	190,911	164,195	180,168
TOTAL	243,264	247,046	232,418	249,311	222,595	238,568
Sites Currently Identified	319	319	319	319	319	319
Future Sites Identified	1,010	1,031	951	1,043	897	984
TOTAL	1,329	1,350	1,270	1,362	1,216	1,304
Properties Currently Eligible for NRHP	42	42	42	42	42	42
Future Properties Eligible for NRHP	133	136	125	137	118	129
TOTAL	175	178	167	179	160	171