

LAKE MEAD NATIONAL RECREATION AREA

**Vegetation Treatment and Hazard Fuel Reduction
2002-2006
Shivwits Plateau Area**

ENVIRONMENTAL ASSESSMENT

**Lake Mead National Recreation Area
Clark County, Nevada
Mohave County, Arizona**

January 2002

US Department of the Interior, National Park Service

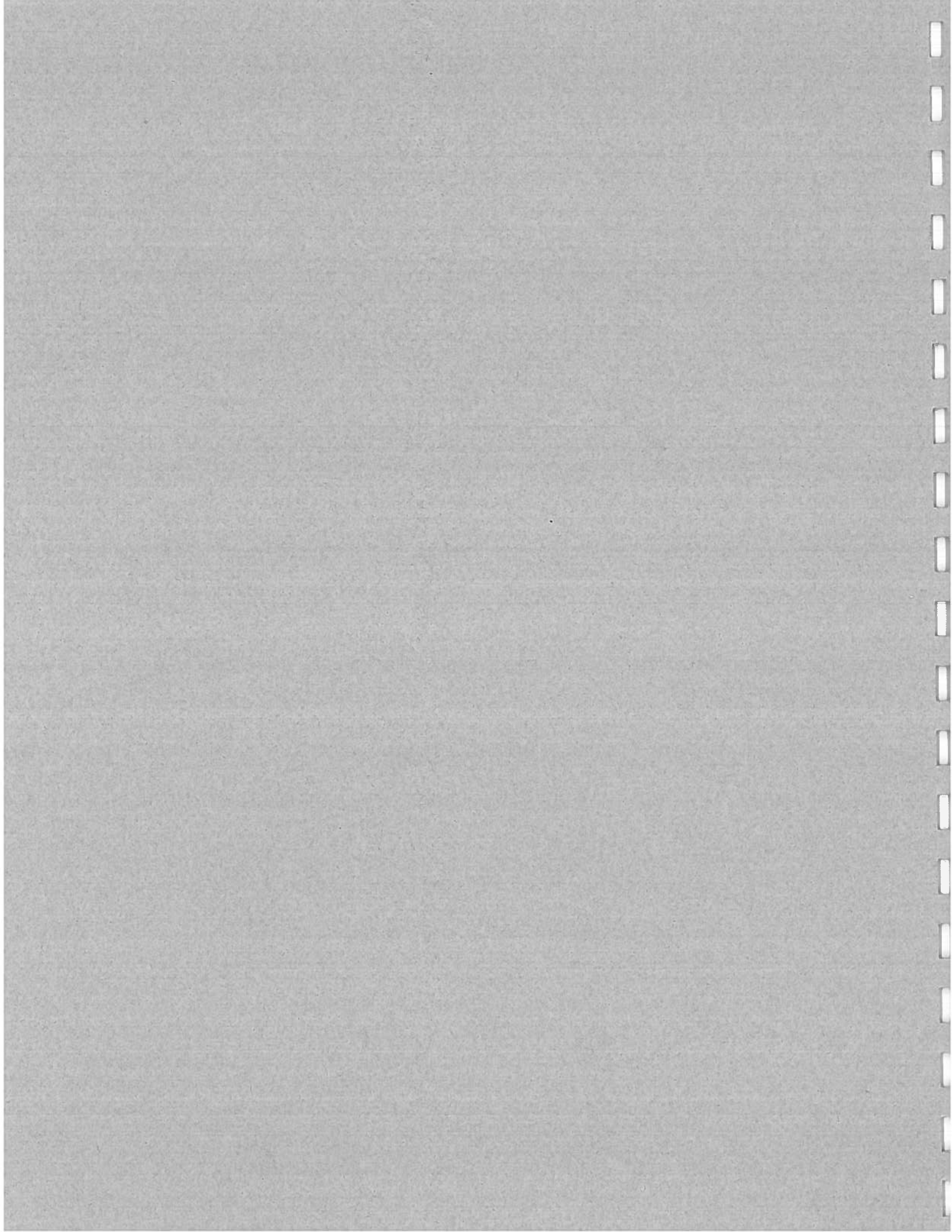


TABLE OF CONTENTS

SECTION 1: PURPOSE AND NEED FOR ACTION

Introduction	1
Purpose and Need	1
Terminology And Definitions	1
Background	5
Environmental Assessment	7
Related Laws, Policies, and Planning Documents.....	7
Potential Issues	9
Issues Considered but Dismissed from Further Consideration	11

SECTION 2: DESCRIPTION OF ALTERNATIVES

Description Of Alternatives	13
Alternative A: No Action – No Use of Prescribed Fire or Chemical Treatment.....	13
Alternative B: Prescribed Fire 5-year Plan.....	13
Alternative C: Combination of Prescribed Fire Treatment and Restoration Thinning	19
(The Preferred and Environmentally Preferred Alternative)	
Alternative D: Chemical Treatment of Vegetation 5-year Plan.....	23
Mitigation And Monitoring.....	23
Alternatives Considered But Eliminated From Further Evaluation	30
Permit Requirements	30
Environmentally Preferred Alternative	31
Comparison of Impacts	31

SECTION 3: AFFECTED ENVIRONMENT

Affected Environment	33
Soils and Vegetation.....	33
Wildlife.....	34
Threatened, Endangered and Sensitive Species.....	35
Riparian Areas	35
Air Quality.....	35
Scenic Quality.....	36
Cultural Resources.....	36
Visitor Use	36
Socioeconomic Resources	37
Recreation Area Operations.....	37
Wilderness Areas	37

SECTION 4: ENVIRONMENTAL CONSEQUENCES

Methodology.....	41
Assumptions for Impact Analysis.....	41

Impairment Analysis.....	43
Cumulative Effects	43
Criteria And Thresholds For Impact Analysis.....	43
Soils and Vegetation	
Related Laws, Regulations, and Policies.....	44
Impact Indicators, Criteria, and Methodology	44
Wildlife	
Related Laws, Regulations, and Policies.....	45
Impact Indicators, Criteria, and Methodology	45
Sensitive, Threatened, and Endangered Species	
Related Laws, Regulations, and Policies.....	46
Impact Indicators, Criteria, and Methodology	46
Riparian Areas	
Related Laws, Regulations, and Policies.....	47
Impact Indicators, Criteria, and Methodology	47
Wilderness Areas	
Related Laws, Regulations, and Policies.....	48
Impact Indicators, Criteria, and Methodology	48
Grazing	
Related Laws, Regulations, and Policies.....	48
Impact Indicators, Criteria, and Methodology	49
Air Quality	
Related Laws, Regulations, and Policies.....	49
Impact Indicators, Criteria, and Methodology	49
Scenic Quality	
Related Laws, Regulations, and Policies.....	50
Cultural Resources	
Related Laws, Regulations, and Policies.....	50
Impact Indicators, Criteria, and Methodology	51
Visitor Use	
Related Laws, Regulations, and Policies.....	52
Impact Indicators, Criteria, and Methodology	52
Safety	
Related Laws, Regulations, and Policies.....	52
Impact Indicators, Criteria, and Methodology	53
Environmental Consequences	53
 Impacts from Alternative A – No Action: No Treatment of Vegetation (No Prescribed Fire or Chemical Treatments)	 53
Soils and Vegetation	53
Wildlife.....	54
Sensitive, Threatened, and Endangered Species.....	55
Riparian Areas	56
Wilderness Areas	56
Grazing.....	57

Air Quality.....	57
Scenic Quality.....	58
Cultural Resources.....	58
Visitor Use	59
Safety	59
Recreation Area Operations	59
Impacts from Alternative B – Prescribed Fire 5-year Plan	
Soils and Vegetation.....	60
Wildlife.....	62
Sensitive, Threatened, and Endangered Species.....	63
Riparian Areas	64
Wilderness Areas	64
Grazing.....	65
Air Quality.....	65
Scenic Quality.....	66
Cultural Resources.....	67
Visitor Use	67
Safety	67
Recreation Area Operations	68
Impacts from Alternative C – Prescribed Fire and Restoration Thinning (Environmentally Preferred and Management Preferred)	
Soils and Vegetation.....	68
Wildlife.....	71
Sensitive, Threatened, and Endangered Species.....	72
Riparian Areas	73
Wilderness Areas	74
Grazing.....	74
Air Quality.....	75
Scenic Quality.....	75
Cultural Resources.....	76
Visitor Use	77
Safety	77
Recreation Area Operations	78
Impacts from Alternative D – Chemical Treatment of Vegetation 5-year Plan	
Soils and Vegetation.....	78
Wildlife.....	80
Sensitive, Threatened, and Endangered Species.....	81
Riparian Areas	82
Wilderness Areas	82
Grazing.....	83
Air Quality.....	83
Scenic Quality.....	84
Cultural Resources.....	84
Visitor Use	85
Safety	85

Recreation Area Operations	85
SECTION 5: COORDINATION AND CONSULTATION	
Coordination And Consultation	87
GLOSSARY OF ACRONYMS.....	89
REFERENCES	91
APPENDICES	
Appendix A: Prescribed Fire Plan	95
Appendix B: Draft Monitoring Plan.....	99
Appendix C: Minimum Requirement Analysis.....	119
FIGURES	
Figure 1-1. Lake Mead Region.....	2
Figure 1-2. Lake Mead and Parashant-Grand Canyon NM.....	3
Figure 1-3. Proposed Treatment Areas	4
Figure 2-1. Proposed Treatment Areas for Prescribed Burns.....	14
Figure 3-1. Shivwits Region Grazing Allotments	38
TABLES	
Table 1-1. Summary of Prescribed Burns on Shivwits Plateau.....	6
Table 2-1. Description of Alternatives	12
Table 2-2. Summary of Vegetative Treatment Units and Acreages.....	15
Table 2-3. Seeding Guidelines	24
Table 2-4. Comparison of Long-Term Impacts	32

SECTION 1: PURPOSE AND NEED

Introduction

The National Park Service (NPS) is considering an adaptive management program involving an experimental 5-year vegetation treatment and hazard fuel reduction on the Shivwits Plateau in Arizona within Lake Mead National Recreation Area (NRA) and the Grand Canyon - Parashant National Monument (GCPNM) (Figures 1-1, 1-2, and 1-3). This document evaluates the no action and three action alternatives and analyzes the various environmental and public health and safety impacts of each alternative. The alternatives analyzed are Alternative A: No action alternative, which is not allowing any vegetative treatment or prescribed fires in the region; Alternative B: Vegetation treatment through the continuation of an experimental prescribed fire program; Alternative C: Vegetative treatment through an experimental program using a combination of prescribed fire and restoration thinning with mechanical treatment, and; Alternative D: Vegetation treatment utilizing an experimental chemical treatment and follow-up burn program.

Various studies have shown that certain vegetation communities have been negatively altered due to fire suppression activities during the last 50 years. These communities include sagebrush, pinyon-juniper, and ponderosa communities such as those that exist on the Shivwits Plateau region of the recreation area. Prescribed fire, mechanical treatment, chemical treatment, and other vegetation treatments can be used as tools to meet the resource management objectives of reintroducing natural processes in the area, restoring forest woodland and grassland communities, and reducing hazard fuel accumulation.

Purpose and Need

The primary purposes of the experimental vegetative treatment program is to attempt to restore fire as a natural process in the Shivwits Plateau region of Lake Mead NRA; to restore fuel loadings and ecosystem structure in vegetative communities that have been altered by past management activities; to increase biodiversity and promote the establishment of native grasses and forbs to aid in preventing soil erosion and increase wildlife forage; and, to restore wildlife habitat and increase potential habitat for sensitive species.

This is an adaptive management program that would continue to be refined based on research, fire effects monitoring, and overall accomplishment of program goals.

Terminology and Definitions

Chaining – a process of clearing vegetation using heavy equipment to drag a chain through the target area to uproot and remove excess vegetation.

Crown Fire – The movement of fire through the crowns of trees or shrubs more or less independently of the surface fire.

Figure 1-1: Lake Mead NRA
Region



Figure 1-2: Lake Mead NRA and Grand Canyon Parashant NM

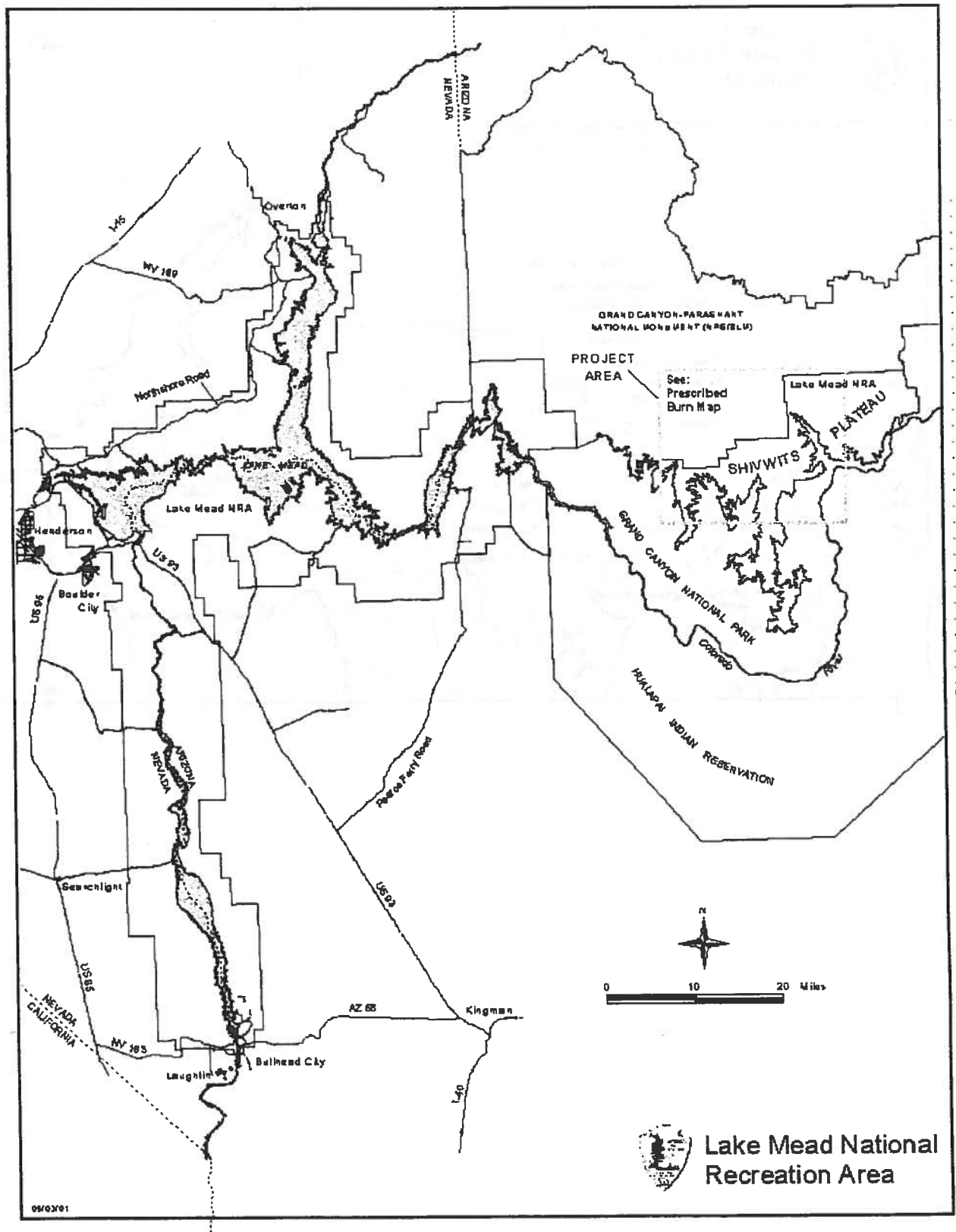
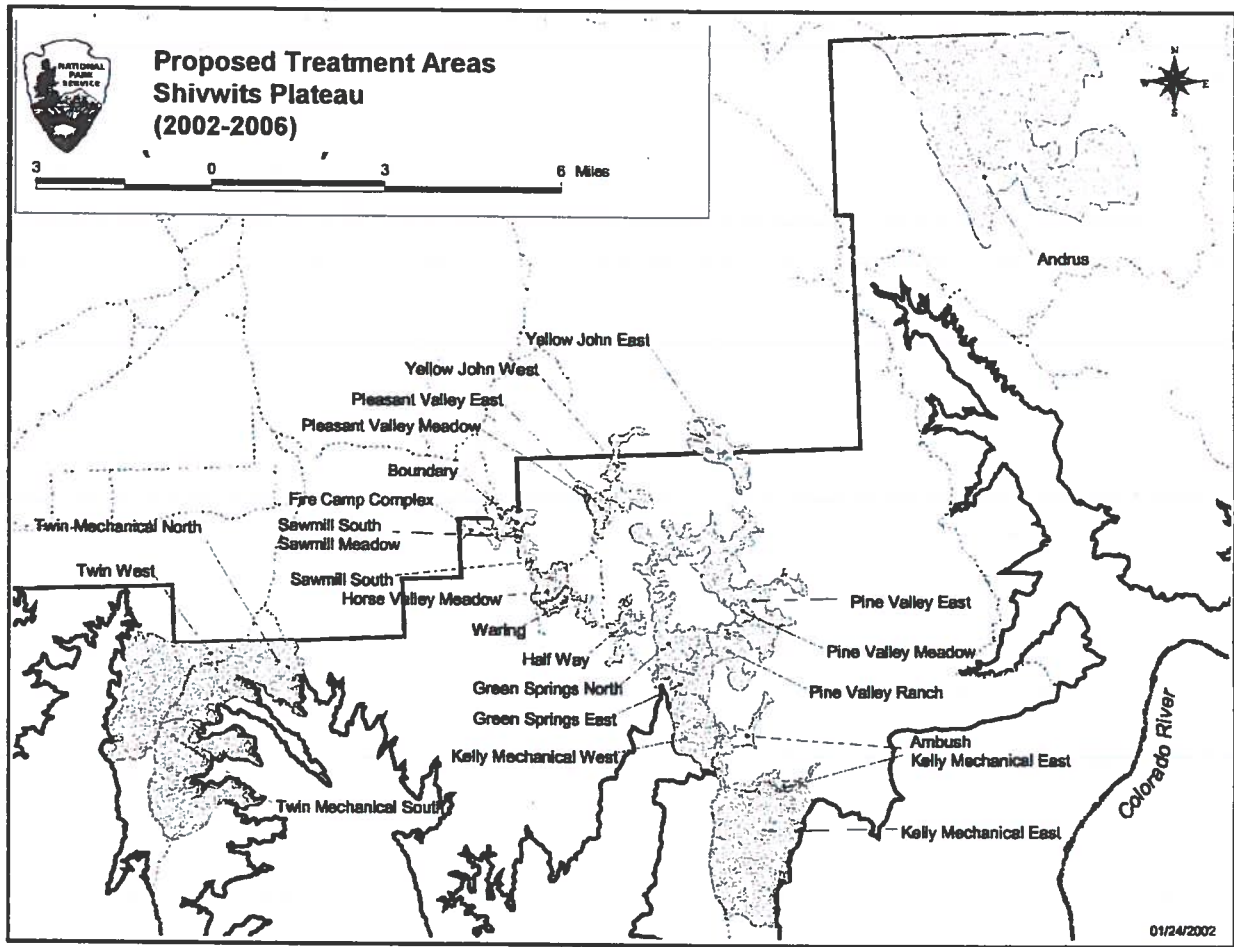


Figure 1-3: Proposed Treatment Areas, Shivwits Plateau



Forb – A plant with a soft, rather than permanent woody stem, that is not a grass or grass-like plant.

Fuel Loading – The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area.

Prescribed Fire – Any fire ignited by management actions under certain, pre-determined conditions to meet specific objectives related to hazardous fuels or habitat improvement.

Prescribed Natural Fire – This term is no longer used. The term used now is “fire for resource benefit.” However, “prescribed natural fire” is used in previous planning documents, which are referenced in this environmental assessment. Prescribed natural fire is defined as fires ignited by natural means (usually lightning) which are permitted to burn under specific environmental conditions, in pre-planned locations, with adequate fire management personnel and equipment available to achieve defined objectives.

Prescription - Measurable criteria that define conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social, or legal considerations.

Snag – A standing dead tree or part of a dead tree from which at least the smaller branches have fallen. Various species of birds often use snags for nesting.

Structural Fire – Fire originating in and burning any part or all of any building, shelter, or other structure.

Wildland Fire – all fires resulting from unplanned ignitions, burning in natural or landscaped vegetation in parks. Although the purpose of this environmental assessment is to evaluate the impacts of prescribed fires, not wildland fires, in the Shivwits Plateau area, this term is included to distinctly portray the difference between the two types of fires. Wildland fires will be addressed in a separate document, the Lake Mead NRA Fire Management Plan.

Background

Prior to 1992, Lake Mead NRA was managed under an operational fire policy that called for suppressing all fire starts, natural or otherwise, whenever possible. The 1992 Lake Mead NRA Fire Management Plan reaffirmed the continuation of a full suppression policy in the park, along with the initiation of a limited, prescribed fire program. The plan called for the implementation of an experimental prescribed fire program on areas of the Shivwits Plateau, Arizona, where past management practices, such as chaining to create pastures, had altered the native vegetation. The objectives of the experimental prescribed fire program were to evaluate the effectiveness of fire in restoring native vegetation and decreasing hazard fuels.

Vegetation treatment and hazard fuel reduction for the recreation area is currently accomplished under the 1992 Fire Management Plan, and a 1993 policy amendment addressing prescribed fires. The following management objectives pertain to the existing prescribed fire program:

1. Protect life and property from the threat of wildfire by reduction of hazardous fuel accumulations associated with values at risk, specifically in areas surrounding park developments and adjacent to predetermined boundary areas.
2. Utilize management ignited prescribed fire/prescribed burns to facilitate the expansion of the prescribed natural fire program into a larger geographical area of the park.
3. Restore fuel loadings and ecosystem structure in vegetative communities that have been significantly altered by past fire suppression and grazing activities.
4. Monitor and evaluate the effects of fire management activities on park ecosystems.
5. Increase potential habitat for wildlife and sensitive species.

A 4-year burn plan on the Shivwits Plateau, identifying specific burn units, was implemented after the adoption of the 1992 plan and 1993 policy. The following experimental burns were completed since that time.

Table 1-1. Completed Prescribed Burns at Shivwits

UNIT NAME	YEAR BURNED	ACRES	PROJECT TYPE
Twin I	1995	407	Juniper, sagebrush
Sawmill	1995	30	Ponderosa Pine
Green Springs	1997	70	Ponderosa Pine
Twin II	1997	1761	Juniper, sagebrush
Horse Valley	1998	67	Ponderosa Pine
Twin Creek	1999	429	Juniper, sagebrush
Twin Spring Boundary	1999	623	Juniper, sagebrush
Twin west	1999	1386	Juniper, sagebrush
Pine Valley Loop	1999	41	Ponderosa Pine
Pleasant Valley	1999	191	Ponderosa Pine
Pine Valley west	1999	170	Ponderosa Pine
Fire Camp Complex	1995,1997	89	Ponderosa Pine
Waring	1997	168	Ponderosa Pine

Since 1994, approximately 4,500 acres of juniper woodlands have been treated at the Twin Point area of the Shivwits Plateau, and about 600 acres of ponderosa pine forests have been treated, both through the use of prescribed burns. The success of the program is being monitored through fire effects monitoring, field studies, and photo points. The burn objectives are being met in some

areas, though recovery results have been mixed in the treatment areas. It is still too early to assess if the program is meeting the overall management goals.

Additional experimental treatments and techniques for vegetation management and fuel reduction have been proposed in the Shivwits area. This environmental assessment is required to evaluate the impacts of the proposed expansion of the experimental vegetation treatment and hazard fuel reduction program for the Shivwits Plateau.

Environmental Assessment

Using the combined goals and objectives from the prescribed fire and the prescribed natural fire programs, park specialists have developed alternative methods that could serve to reach these goals. This environmental assessment evaluates the alternatives and their impacts on the environment and the effects related to the implementation of an adaptive management program, including multi-year vegetation treatment and hazard fuel reduction, in the Shivwits Plateau portion of the recreation area. This document also includes discussions of alternatives that have been ruled out and provides justifications for their elimination. This environmental assessment has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and regulations of the Council of Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] 1508.9).

Related Laws, Policies And Planning Documents

NPS Directors Order 18 (DO-18), Wildland Fire Management, directs that all fires burning within wilderness be classified as either a "wildland fire" or a "prescribed fire." DO-18 also states that park areas will identify, manage, and reduce where appropriate accumulations of hazardous fuels. Prescribed fire and non-fire techniques are listed as one of the appropriate tools for reducing hazardous fuels and DO-18 requires that prescribed fires include monitoring programs that document fire behavior, smoke behavior, fire decisions, and fire effects, in order to provide information on whether specified objectives are met.

In 1997, the Prescribed Natural Fire Plan for the Shivwits Area, Arizona, was implemented. Although this plan referenced prescribed natural fires (ignitions by natural means), not prescribed fires (management-ignited fires), its primary purpose, to meet natural resource management objectives and fire management goals, are similar to those of the prescribed fire program. Specific goals included:

1. Restore fire as a natural process.
2. Use fire as a management tool to meet natural and cultural resource management objectives.
3. Increase diversity and promote the establishment of native grasses and forbs to aid in preventing soil erosion and increase wildlife forage.

4. Restore fuel loadings and ecosystem structure in vegetative communities that have been significantly altered by past fire suppression and grazing activities.
5. Monitor the effects of fire on the ecosystem.

The 1997 Parashant Interdisciplinary Management Plan discusses managing fire for pre-planned enhancement of resources. Objective C of this plan is to restore fire regimes to the highest priority areas within the Parashant Area by the year 2000. The 1999 Resource Management Plan (RMP) cites the exclusion of fire from the recreation area as a threat to native vegetation and specifically states that fire dependent communities, such as the pinyon-juniper, have been altered due to the absence of fire.

The Shivwits area contains both proposed wilderness and proposed potential wilderness. NPS-77, Resource Management Guidelines, the 1999 NPS Directors Order 41 (DO-41), Wilderness Preservation and Management, and the 2000 NPS Management Policies specifically state that the term wilderness includes the categories of *designated, proposed, potential, recommended, study areas, and suitable*, and that wilderness policies apply in these areas regardless of the category.

The NPS is currently drafting an updated Fire Management Plan and environmental assessment that will address unplanned ignitions, the wildland fire use program, fuel management units, types and locations of fire suppression, and mechanical and chemical hazard fuel reduction treatments for the entire recreation area. The Fire Management Plan is intended to establish the overall direction for fire management within Lake Mead NRA and is expected to be completed by summer 2002. Therefore, since the overall program for fire management will be addressed in the Fire Management Plan, this environmental assessment is project specific and focuses only on establishing the overall goals for specifically identified vegetation treatment and hazard fuel reduction areas on the Shivwits Plateau for the next 5 years.

Prescribed fire plans for each individual burn are required by RM-18. Burn plans must be approved individually by the Superintendent, prior to implementation of the burn. Elements to be included in prescribed fire plans are outlined in detail in Appendix A. In addition, RM-18 defines specific prescribed fire monitoring requirements. A copy of these requirements are included in Appendix B.

In addition, RM-18 requires that all prescribed fires be supervised by a certified Prescribed Fire Burn Boss. The burn boss is responsible for ensuring that all prescription elements are met before, during, and after the burn. RM-18 also requires that every position assigned to prescribed fires must meet all national requirements for training and experience, and every prescribed fire incident must be documented on form DI-1202, Individual Fire Report.

The NPS Organic Act directs the NPS to manage units "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner as will leave them unimpaired for the enjoyment of future generations." (16 U.S.C. § 1). Congress reiterated this mandate in the Redwood National Park Expansion Act of 1978 by stating that the NPS must conduct its actions in a manner that will ensure no "derogation of the values

and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress.” (16 U.S.C. § 1 a-1.). The Organic Act prohibits actions that permanently impair park resources unless a law directly and specifically allows for the acts. An action constitutes an impairment when its impacts “harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources and values.” (Management Policies 1.4.3).

NPS Management Policies (2001) requires the analysis of potential effects of each alternative to determine if actions would impair park resources. To determine impairment, the NPS must evaluate “the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts.” (Management Policies 1.4.4). The NPS must always seek ways to avoid or minimize, to the greatest degree practicable, adverse impacts on park resources and values. However, the laws do give the NPS management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment to the affected resources and values (Management Policies 1.4.3).

NPS units vary based on their enabling legislation, natural and cultural resources, missions, and the recreational opportunities appropriate for each unit, or for areas within each unit. An action appropriate at Lake Mead NRA as designated by the enabling legislation, may impair resources in another unit. This environmental assessment analyzes the context, duration, and intensity of impacts related to the vegetation treatment program on the Shivwits Plateau area of Lake Mead NRA, as well as the potential for resource impairment, as required by Director’s Order 12, *Conservation Planning, Environmental Impact Analysis and Decision Making*.

Potential Issues And Impact Topics

The NPS interdisciplinary team has identified potential issues related to the potential environmental impacts that the alternatives may present. The Parashant Planning Team, comprised of BLM and NPS employees, has been working together to identify issues related to the overall management of the PGCNM, which includes portions of the recreation area. In addition, a press release was distributed related to overall fire management within Lake Mead NRA. No written comments were received. If a specific alternative is not cited, the issue applies to all alternatives.

Soils and Vegetation. Under Alternative A, hazardous fuels in certain areas may build up to dangerous levels, resulting in an uncontrollable wildland fire. Under the action alternatives, fires or chemical treatment of vegetation could lead to decreased cover, which could result in soil erosion and run-off, impacting water resources. Non-native vegetation, such as cheat grass, could invade the area after a fire, and potentially change the vegetative community in the treatment area.

Snags, old growth trees, large down logs and rare plant habitat may be located in some proposed treatment units.

Wildlife. Under the action alternatives, wildlife may be displaced during treatment activities, and there may be mortality of animals that are unable to move away from the fire. Wildlife could benefit from improved habitat conditions as a result of treatment activities.

Threatened, Endangered, and Sensitive Species. The threatened bald eagle is a rare winter visitor to the Shivwits area and does not nest in the region. Potential habitat for the threatened Mexican spotted owl occurs on the Shivwits Plateau, though no occurrence has been recorded. Northern goshawk nests have been recorded in coniferous forest on Bureau of Land Management (BLM) administered lands on the Arizona Strip. California condors have been introduced into the area and are considered an "experimental/non-essential" population by the U.S. Fish and Wildlife Service. The Shivwits area is potential habitat for this species.

The rare Grand Canyon rose (*Rosa stellata*) is known to occur near Twin Point on the Shivwits Plateau. *Penstemon distans* is a sensitive plant species that occurs on the northeastern edge of the recreation area. Though neither is a listed species, they are considered sensitive species. The fire ecology of these species is unknown. In general, *Rosa* sp. resprout after low or moderate fire events, but not enough is known about either of these species to assess fire effects.

Riparian Areas. Under Alternatives B and C, escape fires could potentially burn riparian areas and could consume streamside vegetation or upslope cover, leading to increased erosion.

Wilderness Areas. The project area is within both proposed wilderness and proposed potential wilderness. Minimum requirements analysis (Appendix C) will be used to determine the appropriate management actions within proposed and proposed potential wilderness areas. In addition, a minimum tool analysis will be considered to choose the appropriate tools for use in wilderness areas. Suppression and treatment activities could create temporary impacts to the proposed and potential wilderness areas by the use of mechanical equipment, through area closures, and by creating impacts to the visual resources by smoke and the creation of burned areas.

Grazing. Grazing is currently authorized on large portions of the Shivwits Plateau. Fire and chemical treatment of vegetation would impact grazing activities, as ranchers would adjust areas of use based on treatment activity.

Air Quality. Air quality may be impacted by smoke or from chemical treatments. Smoke could temporarily decrease visibility in the recreation area and bordering areas. Chemical treatments could create impacts to air quality from the presence of chemical odors.

Scenic Quality. Under the action alternatives, scenic quality may be adversely affected by cut, burned or chemically treated vegetation. Scenic quality may be impacted by smoke.

Cultural Resources. Under the action alternatives, cultural resources and sacred sites may be located in proposed project areas.

Visitor Use. Temporary closures of certain areas to visitors could occur due to fire activity, suppression, monitoring of prescribed fires, or chemical treatment of vegetation.

Safety. Administrative structures, residential areas, fences, and recreational sites are located in the project area. Under Alternatives B and C, the NPS would address what actions would be taken in the event the prescription is exceeded. Neighboring communities and appropriate public officials may be impacted by such an event.

Recreation Area Operations. Adjacent land uses on BLM administered lands and Grand Canyon National Park (NP) lands are an issue. Fires could spread to these areas, fire behavior and conditions may be unacceptable to the adjacent land manager, or the adjacent land manager may not want to accept the fire for any reason.

Issues Considered but Dismissed from Further Consideration

Several issues were considered during the planning process but were considered insignificant. There is not standing perennial water in the project area so water quality would not be impacted. None of the alternatives would have adverse impacts on wild and scenic rivers as there are none in the area. The project area is not located in a sole or principal drinking water aquifer, wetlands, or floodplains, so no adverse impacts would occur to any of these areas. Since the project area is not in a designated ecologically significant or critical area and is not listed on the Department of the Interior's National Registry of Natural Landmarks, no impacts would occur to these resources. The project would have no impact to socially or economically disadvantaged populations (Environmental Justice EO 12898).

Table 2-1. Description of Alternatives

Alternative A No Action	Alternative B- Prescribed Fire	Alternative C Combination of Prescribed Fire and Restoration Thinning Management Preferred Alternative <i>The Environmentally Preferred Alternative</i>	Alternative D Chemical Treatment
No prescribed fires or chemical vegetation treatments would be utilized.	Prescribed fires in specified treatment areas would be implemented for the purpose of resource benefit and hazard fuel reduction during the 5-year period from 2002 to 2006. Some pinyon/juniper units would require mechanical treatment (use of heavy equipment, chainsaws and tree shearers).	Under this alternative, restoration thinning (use of heavy equipment, chainsaws and tree shearers) would occur in combination with prescribed fires in specified treatment areas for the purpose of resource benefit and hazard fuel reduction during the 5-year period from 2002 to 2006. A combination of treatment methods would be used until results from each technique have been further evaluated.	Chemical treatment of vegetation in specified locations (same treatment areas as those in Alternative 3) would be implemented using herbicide during the 5-year period 2002 to 2006. Herbicide application would be accomplished through aerial spraying from helicopter or fixed-wing aircraft, liquid spray treatments on the ground, granular applications (dry-pellets applied to the soil), and spot treatments applied with backpack sprayers. Once treated, vegetation debris would be removed either through burning or the use of heavy equipment to haul out remaining debris.

SECTION 2: DESCRIPTION OF ALTERNATIVES

Alternative A: No Action - No Use of Prescribed Fire or Chemical Treatment

Under this alternative there would be no treatment of vegetation. Neither prescribed fires nor chemical treatments would be used. Conditions on the Shivwits Plateau would continue to be monitored to determine if previous vegetation management activities resulted in resource benefits.

Alternative B: Prescribed Fire 5-year Plan

This alternative prescribes specific prescribed fires that would be completed for the purpose of resource benefit during the 5-year period starting in 2002 and ending in 2006.

Each prescribed fire would have a specific plan, with designated fire effects monitoring plots, if appropriate. Fire plans would be approved individually by the Superintendent prior to implementation of the burn. Prescribed fire plans would include the elements outlined in RM-18 and discussed in detail in Appendix A. Each prescribed fire would be supervised by a certified Prescribed Fire Burn Boss and documented with the following information:

- Prescribed fire plan
- Map of project
- Monitoring data, including weather, fire behavior, and fire effects observations
- Weather forecasts, spot, short and long-term
- Smoke dispersal information
- Agency individual fire occurrence form

Cultural resource clearance for all proposed burns and associated staging areas would be completed separately for each burn, prior to initiation of the burn, this includes any ground disturbing preparation work, mechanical treatments, etc. For each burn unit, unless otherwise stated, cultural resource clearance has not been completed and would be completed prior to initiation of any burn-related activities. Prescribed fires in pinyon-juniper areas could require mechanical treatment, and could entail the use of light logging equipment, rakes, chainsaws, and tree shears to remove ground debris, ladder fuels, snags, and dead and down woody material to prevent canopy scorch and/or torching.

Government to government consultation with Native American Tribes would be conducted to identify any issues and areas of concern the Native Americans may have relating to the treatment and removal of vegetation and hazardous fuels.

Figure 2-1 shows the specific locations of each proposed prescribed fire. The proposed burn locations and schedules are outlined below:

Figure 2-1
Proposed Treatment Units for Prescribed Burns

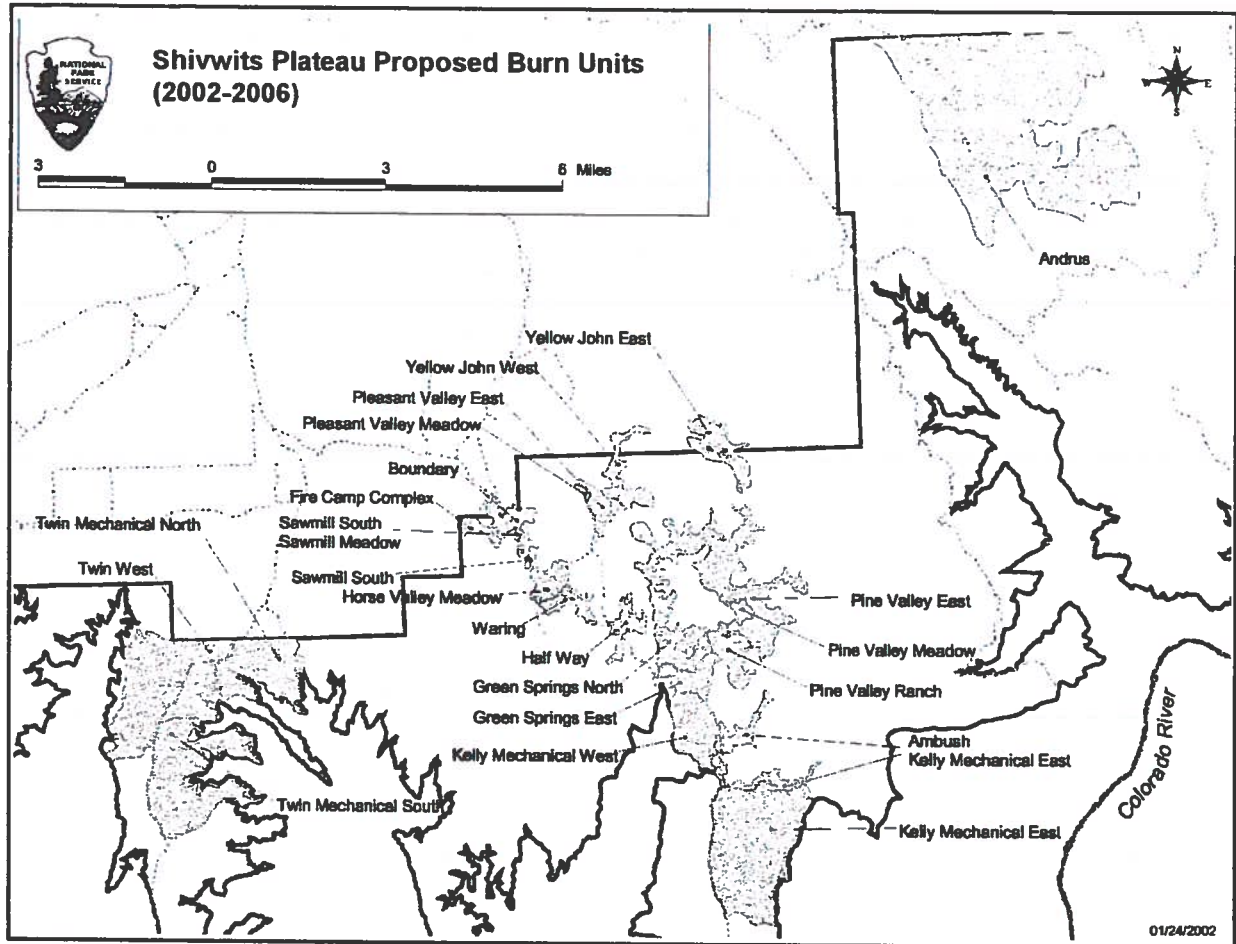


Table 2-2. Summary of Total Acres to be Treated

YEAR	UNIT	ACRES TO BE TREATED
2002	Pleasant Valley East	146
2002	Pine Valley Ranch	294
2002	Green Springs East	266
2002	Twin West (re-entry)	1,386
TOTAL ACRES FOR YEAR 2002		2,092
2003	Green Springs North	741
2003	Pine Valley East	1,214
2003	Pine Valley Meadow	66
2003	Boundary	192
2003	Twin North	1,215
2003	Fire Camp Complex	89
TOTAL ACRES FOR YEAR 2003		3,517
2004	Yellow John East	370
2004	Sawmill South	82
2004	Half Way	200
2004	Pleasant Valley Meadow	21
2004	Waring (re-entry)	168
TOTAL ACRES FOR YEAR 2004		841
2005	Ambush	382
2005	Yellow John West	287
2005	Kelly East	1,957
2005	Horse Valley Meadow	211
TOTAL FOR YEAR 2005		2,837
2006	Kelly West	527
2006	Sawmill Meadow	16
2006	Andrus	5,839
2006	Twin South	1,359
TOTAL FOR YEAR 2006		7,741
TOTAL TREATMENT AREA FOR 5-YEAR PLAN		17,028 acres

2002

Pleasant Valley East : This burn would be east of the Pleasant Valley burn that was completed in 1999, located east of the Pleasant Valley access road and the Pleasant Valley tank. This unit is south of the narrow band of ponderosa pine located at the "choke point" between the Pleasant Valley east unit and the Yellow John west unit. The fuels would be ponderosa pine and 146 acres would be burned. Fieldwork for the cultural resource clearance has been completed for this site, however, the final report is not yet complete and would be required prior to commencing the burn. The burn would be scheduled for 2002.

Pine Valley Ranch: This burn would be in Pine Valley east of the access road and would include those areas north, west and south of the cabin site for a distance of approximately 1/4 to 1/8 mile. The fuel would be ponderosa pine and 294 acres would be burned. Cultural resource clearance for 140 acres of this site has been completed. The burn would be scheduled for 2002.

Green Springs East: This burn would take place in the Green Springs drainage from the junction of the Pine Valley and Kelly Point split, south of the Pine Valley road to the southern edge of the Pine Valley Ranch burn and north of the Kelly Point road. The fuel would be ponderosa pine and 266 acres would be burned. Cultural resource clearance for this site has been completed. The burn would be scheduled for 2002.

Twin West (re-entry): This burn and mechanical treatment would take place in the Twin Point, west, area. The fuel would be pinyon-juniper and 1,386 acres would be treated. Cultural resource clearance for this site was completed in 1998 for the prescribed fire component; however, additional clearance would be required for mechanical treatment. The burn is scheduled for 2002.

2003

Green Springs North: This burn would be north of the Green Springs access road, bordered on the northeast by the Pine Valley east unit and on the southeast by the Pine Valley Ranch unit. All other boundaries are juniper. The fuel would be ponderosa pine and 741 acres would be burned. Cultural resources clearance for this site was initiated in the summer of 2001 and the burn would be scheduled for 2003.

Pine Valley East: This burn would be in Pine Valley, east of the Pine Valley access road. This unit runs from the north all the way south to the northeast boundary of the Green Springs east unit. The fuel would be ponderosa pine and 1,214 acres would be burned. Cultural resources clearance for this site would occur during the summer of 2001 and the burn would be scheduled for 2003.

Pine Valley Meadow: This burn would be located due east of the Pine Valley loop unit and includes only the meadow. The fuel would be sagebrush, grass and forbs and 66 acres would be burned. Cultural resources clearance for this site was initiated in 2001 and the burn would be scheduled for 2003.

Boundary: This burn would be east of the Shivwits administrative site access road and also east of the road going to the Sawmill unit. The unit starts on BLM administered land and goes south to the Sawmill burn unit. The fuel would be ponderosa pine and 192 acres would be burned. The NPS would coordinate with BLM during the drafting of the burn plan. Cultural resource clearance for this site has been completed. The burn would be scheduled for 2003.

Twin North Mechanical: This burn would be located in the northern Twin Point area. The fuel would be juniper and 1,215 acres would be burned. This burn would be a combination of mechanical treatment and prescribed burning. Mechanical treatment may include chainsaws, light logging equipment and tree shears. The burn would be scheduled for 2003.

Fire Camp Complex (re-entry): This unit was originally comprised of three units (Fire Camp, Fire Camp 2 and Fire Camp East). These were burned in 1995 and 1997. Under this proposal, the three units would be combined into one unit located adjacent to the Shivwits administrative site on the east, south and west. Mitigation and suppression measures would be taken to ensure that structures immediately outside of the burn area would not be threatened. The fuel would be ponderosa pine and 89 acres would be burned. An archeological inventory of the area was completed in 1990. A cultural resource clearance will be required prior to initiation of the burn. The burn would be scheduled for 2003.

2004

Pleasant Valley Meadow: This burn would be located in Pleasant Valley. The fuel would be sagebrush and grass and 21 acres would be burned. The meadow would be rehabilitated after the burn. The burn would be scheduled for 2004.

Waring (Re-entry): This burn would be located south of the Waring Ranch access road. It was originally burned in 1997 as a two-unit complex. The fuel would be ponderosa pine and 168 acres would be burned. The burn would be scheduled for 2004.

Yellow John East: This burn would be located adjacent to the Pleasant Valley East unit to the northeast and east. This unit runs to the north and borders BLM administered lands. The fuel would be ponderosa pine and 370 acres would be burned. The NPS would coordinate with BLM during the drafting of the burn plan. The burn would be scheduled for 2004.

Sawmill South: This burn would be south of the Sawmill unit of 1995. It would be located on both sides of the main road bounded in the northeast by the Boundary unit and on the south by juniper. Old growth stumps, logs and snags would be cataloged. The fuel would be ponderosa pine and 82 acres would be burned. The area has been surveyed for cultural resources, however the final report has not been issued. Final cultural resources clearance would be required prior to initiation of the burn. The burn would be scheduled for 2004.

Half Way: This burn would be approximately 1.5 miles southeast of Waring Ranch, immediately east of where the roads splits off to the north and goes into Pleasant Valley from the road going towards Green Springs. The unit would be located on both sides of the road with the majority to

the north. The old growth would be cataloged. The fuel would be ponderosa pine and 200 acres would be burned. The burn would be scheduled for 2004.

2005

Ambush: This burn would be located at the northern edge of the Kelly Point peninsula on both sides of the road but predominantly to the east. The fuel would be ponderosa pine and 382 acres would be burned. The burn would be scheduled for 2005.

Yellow John West: This burn would be located south of Yellow John mountain, northeast of the Pleasant Valley east unit. This unit extends north into BLM administered lands. The fuel would be ponderosa pine and 287 acres (2/3 NPS acres and 1/3 BLM acres) would be burned. The NPS would coordinate with BLM during the drafting of the burn plan. The burn would be scheduled for 2005.

Kelly Mechanical East: This burn would be located east of Kelly Point road on the northern end. The fuel would be juniper and 1,957 acres would be burned. This burn would be a combination of mechanical treatment and prescribed burning. Mechanical treatment may include chainsaws, light logging equipment and tree shears. The burn would be scheduled for 2005.

Horse Valley Meadow: This burn would be located in Horse Valley. The fuel would be sagebrush and grass and 211 acres would be burned. This burn would be part of the meadow rehabilitation project and scheduled for 2005.

2006

Kelly Mechanical West: This burn would be located west of Kelly Point road. Fuel would be juniper and 527 acres would be burned. This burn would be a combination of mechanical treatment and prescribed burning. Mechanical treatment may include chainsaws, light logging equipment and tree shears.

Twin Mechanical South: This burn would be located in the Twin Point area. Fuel would be juniper and 1,359 acres would be burned. This burn would be a combination of mechanical treatment and prescribed burning. Mechanical treatment may include chainsaws, light logging equipment and tree shears. Prior to initiation of this burn, a separate compliance action would be completed to determine the impacts of mechanical treatment on the specific site.

Andrus: This burn would be at Andrus point south of the BLM boundary line to the canyon edge. The fuel would be sagebrush and grass and 5,839 acres would be burned. The burn would be scheduled for summer 2006 and would be coordinated with BLM.

Sawmill Meadow: This fire would be across from the old Sawmill prescribed fire on the east side of the road. The fuel would be sagebrush and exotic mullein and 16 acres would be burned. Exotic plant control would be needed following the burn. The area has been surveyed for cultural

resources, however the final report has not been issued. Final cultural clearance would be required prior to initiation of burn. The burn would be scheduled for 2006.

Alternative C: Combination of Prescribed Fire Treatment and Restoration Thinning

This alternative encompasses the same proposed units as those in Alternative B, however a combination of restoration thinning and prescribed fire treatment, would be the primary methods of treatment in ponderosa pine and juniper units.

Mechanical techniques would vary with each unit. Light-handed mechanical treatment would be used where appropriate, particularly in potential or proposed wilderness areas. The minimum tools for these areas includes chainsaws, scrapers, rakes, and leaf blowers. Scrapers, rakes and leaf blowers would be used to put in fire lines, and to clear areas around old growth and historic fence posts. The potential exists in units near roadways to use a tree shearer and other associated tree removal equipment. This could be the minimum tool depending on the level of clearing necessary, the density of the vegetation, and the available labor. The tree shearer would only be used in units greater than 250 acres.

The restoration thinning method includes thinning tree stands to reduce tree density. The thinning treatment would remove postsettlement trees to emulate the more open stand conditions. Park managers would work with scientists to determine tree ages, appropriate stand density reduction that is most desirable to achieve presettlement conditions, and then mark trees for thinning. Smaller diameter postsettlement trees that are near stumps, snags, and downed presettlement logs would be retained to replicate the clumped pattern characteristic of presettlement forests. No old growth of any kind would be cut. In addition, no standing snags, cavity trees, or trees with nests would be cut. Cultural surveys would occur prior to any treatment. Cultural areas would be flagged and mechanical treatment would not occur in these areas.

The ponderosa pine units would be burned in conjunction with the thinning. The treatment schedule would be modified to achieve resource goals.

Trees may be removed from the management units to reduce the potential for hazard fuel accumulation and for use in local restoration projects. A portable sawmill could be used, if determined appropriate, to prepare trees for the use in local restoration projects. This operation utilizes a medium-sized all terrain vehicle to drag cut trees to a small portable sawmill. The sawmill is a gasoline-powered unit on a trailer that can be moved from location to location. It is likely that this would occur close to existing roads. The boards produced may be used on local restoration projects.

Reseeding would occur on a unit by unit basis, depending on available seed source in the adjacent area, funding, and weather patterns. If reseeded occurs, native western wheat grass and squirrel-tail grass would be used. Hand seeding methods would be used in ponderosa pine forests. More information on seeding is included in the Mitigation Measures section.

Within the areas comprised of pinyon and juniper, the method of thinning would include the use of mechanical techniques as described above. In these units, the goal is to create more fuel for more intense fires. Cutting would occur in rows or grid patterns. No old growth would be cut. The juniper units would be burned after the cut trees dry and to allow native plants to regenerate, typically within three to five years. This would allow for the accumulation of fuel to create a moderate to high intensity fire, which is required to reach the goals in these units. Seeding with native vegetation would occur on a case-by-case basis, depending on the available seed source in the adjacent area, funding, and weather patterns. Either hand seeding or aerial seeding would be used, depending on the size of the unit.

Overall, the benefit of restoration thinning in conjunction with burn treatments is to achieve management objectives with less impact to the resource, for example, reducing the potential for catastrophic fires, soil erosion, and loss of cultural sites. In addition, restoration thinning can offer a wider window for prescribed fire treatments. Thinning and burning could occur year-round based on weather and fuel conditions. Fall and winter are also the optimum time for seeding. Cultural sites can be avoided and protected by management actions.

Trained crews would be required to implement the mechanical treatment and the burning activities, greatly increasing the amount of work required for each unit.

The following is the five-year treatment schedule. Units comprised of ponderosa pine and pinyon-juniper would be treated using appropriate mechanical treatment prior to burning. Burning could occur within several months or several years depending on the fuel type, management prescriptions, and burn conditions. Generally, these dates are the start dates for the mechanical treatment activities within ponderosa pine and pinyon-juniper units.

2002

Pleasant Valley East : This unit is east of the Pleasant Valley burn that was completed in 1999, located east of the Pleasant Valley access road and the Pleasant Valley tank. This unit is south of the narrow band of ponderosa pine located at the "choke point" between the Pleasant Valley east unit and the Yellow John west unit. The fuels would be ponderosa pine and 146 acres would be treated. Fieldwork for the cultural resource clearance has been completed for this site, however, the final report is not yet complete and would be required prior to commencing the burn. A combination of mechanical treatment and burn treatment would begin in 2002.

Pine Valley Ranch: This treatment area would be in Pine Valley east of the access road and would include those areas north, west and south of the cabin site for a distance of approximately ¼-mile. The fuel would be ponderosa pine and 294 acres would be treated. Cultural resource clearance for this site has been completed. The treatment would begin in 2002.

Green Springs East: This treatment would take place in the Green Springs drainage from the junction of the Pine Valley and Kelly Point split, south of the Pine Valley road to the southern edge of the Pine Valley Ranch burn and north of the Kelly Point road. The fuel would be

ponderosa pine and 266 acres would be treated. Cultural resource clearance for this site has been completed. The treatment is scheduled to begin in early 2002.

Twin West (re-entry): This treatment area would entail the retreatment of the western area of Twin Point and would include mechanical treatment and burn treatment. The fuel would be pinyon-juniper and sagebrush and 1,386 acres would be treated. Cultural resource clearance for this site was completed for the initial prescribed burn in 1998. However, no clearance was completed for the mechanical component of the treatment, and it would be completed prior to initiating the project. The treatment is scheduled to begin in 2002.

2003

Green Springs North: This unit would be north of the Green Springs access road, bordered on the northeast by the Pine Valley east unit and on the southeast by the Pine Valley Ranch unit. All other boundaries are juniper. The fuel would be ponderosa pine and 741 acres would be treated. Cultural resources clearance for this site would be started during the summer of 2001 and the treatment would be initiated in 2003.

Pine Valley East: This unit would be in Pine Valley, east of the Pine Valley access road. This unit runs from the north all the way south to the northeast boundary of the Green Springs east unit. The fuel would be ponderosa pine and 1,214 acres would be treated. Cultural resources clearance for this site was started summer 2001 and the treatment would commence in 2003.

Pine Valley Meadow: This unit is due east of the Pine Valley loop unit and includes only the meadow. The fuel would be sagebrush, grass and forbs and 66 acres would be burned. Cultural resources clearance for this site was started summer of 2001 and the burn would be scheduled for 2003.

Boundary: This unit is east of the Shivwits administrative site access road and also east of the road going to the Sawmill unit. The unit is adjacent to BLM administered land and goes south to the Sawmill burn unit. The fuel would be ponderosa pine and 192 acres would be treated. The potential exists to do a cooperative burn with the BLM. Cultural resource clearance for this site has been completed. The treatment would commence in 2003.

Twin North Mechanical: This unit would be located in the northern Twin Point area. The fuel would be juniper and 1,215 acres would be treatment. The treatment would be scheduled to begin in 2003.

Fire Camp Complex (re-entry): This unit was originally comprised of three units (Fire Camp, Fire Camp 2 and Fire Camp East). These were burned in 1995 and 1997. Under this proposal, the three units would be combined into one unit located adjacent to the Shivwits administrative site on the east, south and west. Mitigation and suppression measures would be taken to ensure that structures immediately outside of the burn area would not be threatened. The fuel would be ponderosa pine and 89 acres would be treated. Cultural resources clearance was completed in 1990. The treatment would be scheduled to start in spring 2003.

2004

Pleasant Valley Meadow: This burn would be located in Pleasant Valley. The fuel would be sagebrush and grass and 21 acres would be burned. The meadow would be rehabilitated after the burn. The burn would be scheduled for 2004.

Waring (Re-entry): This unit is located south of the Waring Ranch access road. It was originally burned in 1997 as a two-unit complex. The fuel would be ponderosa pine and 168 acres would be treated. Cultural resource clearance for this site has been completed. The treatment would be initiated in 2004.

Yellow John East: This unit is located adjacent to the Pleasant Valley East unit to the northeast and east. This unit runs to the north and is adjacent to BLM administered lands. The fuel would be ponderosa pine and 370 acres would be treated. The potential exists for the NPS to coordinate with BLM during the burn. The treatment would be scheduled to begin in 2004.

Sawmill South: This unit is south of the Sawmill unit of 1995. It would be located on both sides of the main road bounded in the northeast by the Boundary unit and on the south by juniper. Old growth stumps, logs and snags would be cataloged. The fuel would be ponderosa pine and 82 acres would be treated. The area has been surveyed for cultural resources, however the final report has not been issued. Final cultural resources clearance would be required prior to initiation of the burn. The treatment would commence in 2004.

Half Way: This unit is approximately 1.5 miles southeast of Waring Ranch, immediately east of where the roads splits off to the north and goes into Pleasant Valley from the road going towards Green Springs. The unit would be located on both sides of the road with the majority to the north. The old growth would be cataloged. The fuel would be ponderosa pine and 200 acres would be treated. The treatment would commence 2004

2005

Ambush: This unit would be located at the northern edge of the Kelly Point peninsula on both sides of the road but predominantly to the east. The fuel would be ponderosa pine and 382 acres would be treated. The treatment would be scheduled to begin in 2005.

Yellow John West: This unit would be located south of Yellow John mountain, northeast of the Pleasant Valley east unit. This unit extends north into BLM administered lands. The fuel would be ponderosa pine and 287 acres would be treated. The potential exists for the NPS to coordinate with the BLM during the burn. The treatment would be scheduled to commence in 2005.

Kelly Mechanical East: This unit would be located east of Kelly Point road on the northern end. The fuel would be juniper and 1,957 acres would be treated. The treatment would be scheduled to commence in 2005.

Horse Valley Meadow: This burn would be located in Horse Valley. The fuel would be sagebrush and grass and 211 acres would be burned. This burn would be part of the meadow rehabilitation project and scheduled for 2005.

2006

Kelly Mechanical West: This unit would be located west of Kelly Point road. Fuel would be juniper and 527 acres would be treated. Treatment is scheduled to begin in 2006.

Twin Mechanical South: This unit would be located in the Twin Point area. Fuel would be juniper and 1,359 acres would be treated. Treatment is scheduled to begin in 2006.

Andrus: This burn would be at Andrus point south of the BLM boundary line to the canyon edge. The fuel would be sagebrush and grass and 5,839 acres would be burned. The potential exists to coordinate this burn with the BLM. The treatment would commence in 2006.

Sawmill Meadow: This treatment area would be across from the old Sawmill prescribed fire on the east side of the road. The fuel would be sagebrush and exotic mullein and 16 acres would be burned. Exotic plant control would be needed following the burn. The area has been surveyed for cultural resources, however the final report has not been issued. Final cultural clearance would be required prior to initiation of burn.

Alternative D: Chemical Treatment of Vegetation 5-year Plan

This alternative encompasses the same proposed units and timeframes as those in Alternatives B and C, however, all treatment would be implemented using chemical methods, which entails the use of herbicide. Herbicide application would be accomplished through aerial spraying from helicopter or fixed-wing aircraft, liquid spray treatments on the ground, granular applications (dry-pellets applied to the soil), and spot treatments applied with backpack sprayers. Once treated, vegetation debris would be removed either through burning or the use of heavy equipment to haul out remaining debris. All debris burning would be reviewed by a fire management officer and conducted in compliance with local, state, and federal air quality requirements and permits.

Mitigation And Monitoring

Mitigation measures are specific actions that when implemented reduce impacts, protect park resources, and protect visitors. The following mitigation would be implemented under the alternative(s) specified and are assumed in the analysis of effects for the alternative.

Soils and Vegetation. Under all of the action alternatives, seeding of native species may be used to assist in the recovery of treatment areas, prevent soil erosion and runoff, and to reduce the potential for non-native invasions. If necessary, exotic plant control would be considered as a follow up action.

The goals of the seeding program is to restore vegetative community structure, density, and species composition similar to conditions that existed prior to grazing and logging; to reduce soil erosion potential; increase biological diversity; and to provide for a variety of mosaic wildlife habitats.

The following table includes the Lake Mead NRA native grass seeding guidelines for vegetation treatment projects in the three major vegetation types.

Table 2-3. Seeding Guidelines for Native Plants	
Major Vegetation Types	
Juniper:	Description: Dominated by juniper, intermixed with pinyon pine, sagebrush and other brush species, minimal grass.
	Site history: Previously dominated by native bunch grasses with scattered and mosaic stands of juniper. Cattle grazing since mid 1800s.
	Impacts: Woody perennials species have encroached and replaced grass sites due to grazing and fire suppression. Most of the juniper is less than 90 years old. Sites are suffering from erosion or are susceptible to undesirable erosion.
	Restoration treatment objectives: Reduce post settlement tree and shrub species and increase native grass cover.
Sagebrush:	Description: Dominated by sagebrush intermixed with rabbitbrush and varying amounts of several grass species.
	Site History: Grazing since mid 1800s. Areas previously included more grass and less sagebrush.
	Impacts: Increased soil erosion, lack of biological diversity, brush species has replaced grass dominance.
	Restoration Treatment Objectives: Reduce brush species and increase native grass cover.
Ponderosa Pine:	Description: Dominated by ponderosa pine intermixed with juniper, pinion pine, gambel oak, sagebrush and minimal grass.
	Site History: Logging operations removed most large old growth ponderosa pine trees from the late 1800s to the 1930s. Excessive grazing since mid 1800s. Aggressive fire suppression has occurred since the early 1900s. Large trees with open, park-like setting with grass understory maintained by frequent wildfires.

	Impacts: Dense even aged stands of ponderosa pine have replaced the open park-like stands after logging ceased. Lacks grass understory due to closed canopy. Other tree and shrub species have encroached into understory due to lack of fires needed for thinning. Remaining old growth trees are threatened by direct competition from increased tree density and from high intensity wildfire fueled by the dense understory.
	Restoration Treatment Objectives: Reduce post settlement trees to densities that more closely represent pre-European settlement conditions (10-50 trees per acre). Increase grass cover.

Seeding Criteria:

Purpose of seeding:

Some treatment areas may be vulnerable to erosion on a short-term basis until vegetation re-establishes. Seeding with desirable species mitigates soil erosion potential and introduces immediate competition with undesirable species establishment.

Sources:

Grass seed collection has been initiated and is being prepared and stored at Lake Mead NRA Plant Nursery. Grass collection from the area will continue on an annual basis however the amounts will be subject to availability of seed and labor. The majority of grass seed will need to be purchased from commercial sources. There are numerous commercial sources and only certified "weed free" seed will be utilized. Purchased seed will be selected from cultivated sources that have similar environmental conditions to our project sites.

Seeding Decision Criteria:

It is recognized that the most desirable site recovery will occur by natural processes and it will usually not be feasible to seed entire project areas. Flat terrain exists throughout much of the Shivwits Plateau, which greatly reduces soil erosion potential. Therefore, drainages and areas with slope will receive the highest priority for seeding to aid recovery in those areas with the greatest erosion potential.

The need for seeding will be evaluated on a project by project and site by site basis. If ample grass exists on site or immediately adjacent to the treatment sites prior to vegetation treatments, then it will not be necessary for supplemental seeding. Experience from previous treatments has shown that existing grass on site increases after burning. Areas that are void of desirable grasses will receive priority for seeding. Due to the high cost of seeding, most seeding operations will target optimal areas for seed germination. The southwest portions of treatment sites will also receive priority for seeding due to the prevailing southwest winds related to seed dispersal. Most seeding will occur during the fall season from September through November. Debris or "vertical mulching" will be utilized when appropriate to accommodate "safe sites" for seed germination.

Methods:

Seed will be dispersed by hand driven "whirlybird" type seed hoppers. Hand raking may follow seeded areas to assist with seedbed preparation. Other methods may include driving an ATV with a mounted seed hopper depending on cultural resource sensitivity of the specific project area. Ariel seeding with planes or helicopters may also be considered but is not likely due to high expense and relatively small project areas.

Species:

Only native species will be included in the seeding projects. Perennial grass species will be the primary focus of seeding projects. All of the species listed below are native perennial grasses that are common throughout all three vegetation types where treatments will occur. Other native species may be considered and the percentage of species mixture will vary according to availability and cost.

Squirreltail (*Elymus elymoides*)

Western Wheatgrass (*Agropyron smithii*)

Blue Grama (*Bouteloua gracilis*)

Sideoats Grama (*Boutoula curtipendula*)

Mat Muhly (*Muhlenbergia richardsonis*)

Monitoring:

Restoration treatments and seeding activities will be monitored and evaluated on an annual basis. Vegetation plots, photo monitoring, and observations will be compiled for analysis to determine treatment effectiveness. Adaptive management principles will be applied throughout all phases of restoration treatments.

Under Alternatives B and C, fire lines and other soil scars would be restored after the completion of treatment activities. Fire crews would be dispatched to construct control lines around snags, old growth trees, and large down logs, and rare plant habitat would be designated as fire suppression zones.

Under Alternative C, thinning would occur in portions of the ponderosa pine treatment areas and only postsettlement trees would be designated for thinning. Cut trees could be removed from ponderosa pine treatment areas to reduce the potential for hazard fuel accumulation. Resource specialists and prescribed fire specialists will determine when removal of the cut trees is appropriate.

Under Alternative D, in order to prevent soil and seed contamination and adverse, long-term ecosystem impacts, only herbicides with low persistence in the environment, previously approved by the NPS for use, that do not threaten the health of surrounding plants or wildlife, would be used. With the exception of aerial spraying, use of chemicals would be localized to the vegetation being treated.

Wildlife. Under the action alternatives, surveys would be conducted on potential nesting cavities and all areas where nesting sites are found would be designated as suppression zones and no

treatment would occur. Maps of existing sites and habitat would also be consulted when making decisions and designating suppression or non-treatment zones.

Under the action alternatives, vegetation treatments would be monitored on the ground and a resource management specialist would be present. Under Alternative B, appropriate suppression activities would take place if biologists determine that a fire would adversely impact wildlife habitat. Under Alternative D, if biologists determine that a chemical treatment would adversely impact wildlife habitat, the area would not be chemically treated.

Threatened, Endangered, and Sensitive Species. No threatened or endangered species have been known to occur in the project area, though potential habitat does exist. Sensitive species have been found within the project area.

Maps of existing and potential habitat would be consulted when planning and implementing the prescribed burn or chemical treatment areas, and suppression and non-treatment zones would be designated around potential and known habitat for threatened, endangered, and sensitive species. A qualified biologist would oversee surveys which would occur within each area prior to any treatment activity to determine if there are nest sites or occupancy by threatened or endangered species. If species or nests are found during the survey, activities would be halted and formal consultation would be initiated.

Surveys for northern goshawks should be conducted in all areas in which fire activities are planned, and no activity would occur in areas where goshawks are nesting. Goshawks have a lengthy nesting period. Courtship and nest-building may begin as early as two months before egg-laying. After eggs are laid, the incubation period is 5 to 6 weeks. Once the young birds have hatched, they remain in the nest for another 5 to 6 weeks and do not attain complete independence from the parents until they are approximately 80 days old. As a result, the sensitive period for breeding goshawks extends from early March through late September. Any burning scheduled for this period should be preceded by a goshawk survey. Goshawk surveys will be coordinated through the Wildlife Branch of the Resource Management Division, Lake Mead NRA. If goshawks are discovered in an area proposed for burning, fire managers will consult with the park's wildlife biologists to determine an acceptable course of action, which may include delaying the burn schedule or altering the location of the proposed burn.

In addition, informal consultation with the U.S. Fish and Wildlife Service (USFWS) would be conducted to finalize the determination of no effect, or not likely to adversely affect, threatened or endangered species.

Riparian Areas. Under Alternatives B and C, suppression actions would be undertaken to prevent riparian areas from burning in order to preserve streamside vegetation and upslope cover and prevent further erosion.

Wilderness Areas. Under Alternatives B and C, burn methods used would be those that would minimize the impact of the action and the fire itself to ensure that the wilderness character is preserved.

The "Light Hand" suppression techniques would be employed for all fire activities where determined appropriate after a minimum tool evaluation. Light hand suppression involves the use of minimum impact strategies and tactics. Each burn unit would be evaluated on a case-by-case basis to determine the appropriate tools. The appropriate tool would depend on the acreage of the treatment area, the location of the unit, the resource goal for that unit, the timing of the treatment, and the staff available for the treatment.

Prescribed burn units are located and designed to make use of natural and unnatural fuel breaks. Lake Mead NRA burn unit boundaries utilize roads, natural fuel breaks, and natural features such as canyon rims, rocks and drainages. This avoids the use of constructed fire-lines; and most burns do not require any perimeter fireline construction. Light hand tactics in prescribed burns also exclude the use of bulldozers. Handlines are the only constructed fireline used at Shivwits. Indirect fire suppression strategy using natural barriers and backfiring and burnout creates less impact and line construction than direct attack.

Other light hand suppression actions include air attack using retardant lines, engines and helicopters using "wetlines", and "coldtrailing" the fire perimeter instead of line construction.

Fire lines and other soil scars would be restored after the completion of management activities. Park managers would apply the minimum requirement concept to determine the appropriate management practice and the minimum tool analysis to determine the appropriate equipment used in proposed and potential wilderness areas in order to preserve the wilderness character of the area.

Under Alternatives B, C and D, minimum tool requirements would be analyzed for each unit and the appropriate tool would be used.

Grazing. Under Alternatives B, C and D, grazing may be temporarily restricted in some treatment areas. However, after a period of 1 to 2 years, grazing could be reinstated in certain treatment areas if park biologists determine that these areas are suitable for grazing.

Air Quality. Smoke management is critical within this region when managing any form of fire. Arizona Department of Environmental Quality (ADEQ) smoke management procedures, requirements, and recommendations would be followed during all phases of a prescribed fire, during any suppression activity, or during burning of treated vegetation debris. Under alternatives B, C, and D a burn plan would be submitted to ADEQ for approval upon designation of a prescribed fire, followed by a daily burn request and accomplishment report. Under alternatives B, C, and D, monitoring of smoke would be a high priority that would include volume, dispersal, mixing heights, atmospheric conditions, and any other smoke concerns.

Scenic Quality. Under the action alternatives, management objectives would include requirements that the existing character of the natural landscape be retained. Any changes caused by the treatment of vegetation would repeat the basic elements (line, form, color and texture) found in the predominate natural features of the landscape. Cut trees could be removed from the

ponderosa pine treatment areas under Alternative C to reduce the visual impact from unnatural levels of downed trees.

Cultural Resources. Under all action alternatives archeological clearances will be completed prior to the initiation of all project activities.

Under Alternatives B and C, fire suppression zones would be designated around known cultural and historic resources that could be adversely affected by fire. In addition, a cultural resource specialist would be on site to monitor prescribed fires for adverse impacts to cultural resources and appropriate suppression activities would take place if a determination was made that the fire would adversely impact cultural resources. Suppression activities would include fire crews being dispatched to construct control lines around known cultural and historic resources, removal of downed logs and other heavy fuel sources from sites, and removal of hazardous trees from around structures and ruins. The sites that are identified in the archeological clearance as being susceptible to erosion after burning will be monitored.

Under Alternatives C and D, known cultural areas would not be treated and if previously unknown cultural resources are discovered, treatment would be discontinued in the area. If burning is planned after the chemical treatment, then the procedures described under Alternative B above would be followed.

Visitor Use. Under all action alternatives, visitors would be directed to alternate recreation sites and informed that fire suppression activities, prescribed fire activities, or vegetation treatments were taking place.

Safety. Fire crews would wear required personal protective equipment (PPE) at all times during any prescribed fire, fire suppression, or debris burning activities. Mandatory PPE includes:

- 8-inch high, laced, leather boots with lug soles
- Fire shelter
- Hart hat with chin strap
- Goggles/safety glasses
- Ear plugs
- Nomex shirts
- Nomex trousers
- Leather gloves

No PPE would be purchased that is not National Fire Protection Association compliant or that does not meet standards.

Under Alternatives B and C, each burn plan would contain holding and wildland fire transition plans describing appropriate actions in the event the prescription is exceeded. All burn plans would address the need for alerting park neighbors and appropriate public officials to the objectives and timing of the planned burn and designate a specific individual as responsible for making these notifications. No fires would be ignited unless the responsible personnel determined

immediately prior to the fire that optimum conditions to prevent the fire from exceeding prescription existed.

Under Alternatives B and C, fire suppression zones would be designated around administrative structures, residential areas, and recreational sites. In these areas, appropriate suppression activities would occur to protect these resources.

Under all alternatives, hazard fuel reduction would occur around residential, historic, and administrative structures to prevent wildland or structural fires in these areas.

Recreation Area Operations. Under Alternatives B and C, fire management units would be established in the prescribed fire plan. Prescriptions would be set within these units to determine the appropriate management action. The purpose of these prescriptions and the decision and criteria process are to prevent prescribed fires from developing into high-intensity wildfires in ponderosa pine woodlands and allow managers to meet resource objectives in sagebrush and pinyon-juniper communities.

Under Alternatives B and C, fire effects monitoring would be completed in selected plots after each burn to evaluate the degree to which objectives are accomplished. Long-term monitoring of the overall project would be required to document that overall programmatic objectives are being met and undesired effects are not occurring.

The policies for handling an escaped prescribed fire are contained within RM-18 and existing Interagency Agreements and would be followed under this plan.

Alternatives Considered But Eliminated From Further Evaluation

Mechanical treatment of vegetation in all proposed fire units was considered for the Shivwits area. However, this alternative was eliminated based on NPS DO-41, Wilderness Management Policies, which specifically requires the use of the least intrusive tool, equipment, device, force, regulation or practice determined necessary to accomplish an essential task in wilderness or potential wilderness areas. Use of mechanical treatment to accomplish vegetation removal for the entire Shivwits area does not fit this category, as less intrusive methods are available. There are some areas that would require mechanical treatment and these areas are specifically identified and addressed in Alternatives B and C.

A variety of additional locations in the Shivwits area were considered for prescribed fires but it was determined that the proposed burn units are the most suitable locations to achieve resource benefit, reduce hazardous fuels, and not exceed prescriptions.

Bio-control was considered but determined to be infeasible. The vegetation managed in this plan primarily includes native species (ponderosa pine, juniper forests and sagebrush). Biological control has not been developed for these species because they are desirable native species and the concern is plant density. Meeting the objectives for managing plant density can be accomplished in priority areas using intense management strategies such as prescribed burning, mechanical

treatment, and chemical treatment. These species have timber value and biological control provides little control over where it is applied, and it may not be compatible with surrounding landowners. It is also against NPS Policy to implement bio-control of native species.

Permit Requirements

This project does not require compliance with Executive Order 11988 (Floodplain Management), Executive Order 11900 (Protection of Wetlands), or the Fish and Wildlife Coordination Act.

Under Alternatives B and C, upon designation of each prescribed fire, a separate burn plan would be submitted to ADEQ for approval, followed by a daily burn request and accomplishment report. In addition, an approved burn plan for each prescribed fire would be filed in the Lake Mead NRA Superintendent's office prior to each burn. Requirements for the burn plan are outlined in Appendix A.

Environmentally Preferred Alternative

The environmentally preferred alternative is the alternative that will promote NEPA, as expressed in Section 101 of NEPA. This alternative will satisfy the following requirements:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- Assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable or unintended consequences;
- Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and,
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Alternative C is the environmentally preferred alternative because, overall, it would best meet the requirements of Section 101 of NEPA. It would help enhance the quality of the vegetative communities on the Shivwits Plateau, while preserving important historic, cultural, and natural aspects of our national heritage.

Comparison Of Impacts

Table 2-4 summarizes the potential long-term impacts of the proposed alternatives. Short-term impacts are not included in Table 2-4, but are analyzed in Section 4. Impact intensity, context, and duration are defined in Section 4.

Table 2-4. Comparison of Long-Term Impacts from Alternatives Considered

IMPACT TOPIC	ALTERNATIVE A (No Action)	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D
Soils and Vegetation	Potentially major adverse impacts	Potentially moderate to major beneficial impacts	Potentially moderate to major beneficial impacts	Potentially moderate to major beneficial impacts
Wildlife	Potentially major adverse impacts	Moderate to major beneficial impacts	Potentially moderate to major beneficial impacts	Potentially moderate to major beneficial impacts
Threatened and Endangered Species	No long-term impacts	No long-term impacts	Potentially moderate beneficial impacts	No long-term impacts
Riparian Areas	No long-term impacts	No long-term impacts	No long-term impacts	No long-term impacts
Wilderness Areas	No long-term impacts	Potentially moderate to major beneficial impacts	Potentially moderate to major beneficial impacts	Potentially minor to moderate adverse impacts
Grazing	Potentially major adverse impacts	Potentially moderate beneficial impacts	Potentially moderate beneficial impacts	Potentially moderate beneficial impacts
Air Quality	No long-term impacts	No long-term impacts	No long-term impacts	No long-term impacts
Scenic Quality	No long-term impacts	Potential for minor to moderate beneficial impacts	Potential for minor to moderate beneficial impacts	Potential for minor to moderate beneficial impacts
Cultural Resources	Potential for major adverse impacts	No long-term impacts	No long-term impacts	No long-term impacts
Visitor Use	No long-term impacts	No long-term impacts	No long-term impacts	No long-term impacts
Safety	Potential for moderate to major adverse impacts	No long-term impacts	No long-term impacts	No long-term impacts
Recreation Area Operations	No long-term impacts	No long-term impacts	No long-term impacts	No long-term impacts

SECTION 3: AFFECTED ENVIRONMENT

This section describes the portion of the natural and human environment that may be affected by the proposal and alternatives under consideration. A complete and detailed description of the environment and existing use in the Shivwits Plateau area can be found in the 1999 Resource Management Plan, the 1997 Parashant Interdisciplinary Management Plan, and the 1986 General Management Plan.

The Shivwits Plateau portion of Lake Mead NRA is an extremely remote area within the Arizona Strip located on the northwest rim of the Grand Canyon (Figure 1-2). It is 90 miles south of St. George, Utah. Most of the area is without roads. Vehicular access to the area is via unpaved county roads with varying road conditions. Bordering the north side of the recreation area boundary is primarily BLM administered lands, while Grand Canyon NP is adjacent on the south and east. It is within the boundaries of GCPNM. Elevations average around 6,000 feet, and the area averages 14 to 18 inches of rainfall per year.

Soils and Vegetation

The soils of the Shivwits Plateau consist mainly of clay, loam, limestone, gypsum, and basalt. A complete breakdown of soil dispersal is available in the Parashant Interdisciplinary Management Plan.

Vegetation in the area includes approximately 168,000 acres of sagebrush (*Artemisia tridentata*), pinyon (*Pinus monophylla*) - juniper (*Juniperus osteosperma*) woodlands, ponderosa pine (*Pinus ponderosa*), and blackbrush (*Coleogyne ramosissima*) communities. Natural grassy clearings occur among the ponderosa and pinyon-juniper forests. Other areas of this ecotype differ as a result of recent vegetative manipulation. For example, sagebrush was treated to create grasslands.

Pinyon and juniper woodlands are the most prevalent vegetation type. Much of the pinyon-juniper woodland is a closed stand with little understory vegetation so biodiversity is low. The lack of grasses and shrubs beneath the trees has increased soil erosion. Vegetative manipulations such as chaining have been conducted in the past to increase forage for livestock and wildlife. Older chaining areas are reverting to sagebrush with encroaching pinyon and juniper.

Forest areas are composed primarily of 80 to 90-year-old ponderosa pine with a few old growth trees. There is fairly good recruitment of young trees. Timber harvesting occurred in the early settlement period and as late as the 1950s. In some areas, nearly all the trees were removed. In other areas, pole-sized trees were left and have since grown into well-configured stands. Fire suppression and other land use activities occurring since settlement of the area have resulted in even-aged stands with dense dog-hair thickets and dangerous accumulations of forest floor litter.

Currently, the Shivwits Plateau has no large or rapidly spreading infestation of noxious weeds. There are however, isolated spots where two known noxious weed species occur. The two species presently known to occur are field bindweed (*Convolvulus arvensis*) and scotch thistle

(*Onopordum acanthium*). Efforts to control and eradicate the scotch thistle are already taking place. Control efforts on field bindweed have not yet taken place due to its site specific limitations and potential to spread.

Sagebrush flats are found in the Whitmore Point and Andrus Point areas. Biodiversity is typically quite low in most sagebrush areas due to the dominant monoculture. Vegetative conversions such as pinyon-juniper removal and chemical applications have been conducted in the past to increase diversity, improve soil protection and provide forage for livestock and wildlife. These conversions tend to revert back to sagebrush.

Desert shrub communities, characterized by sparse, xeric vegetation, can be found in the bottoms of Andrus and Parashant canyons and lower elevations along the western side of the area.

Wildlife

The vegetation provides habitat for a variety of wildlife species, including mule deer, desert bighorn sheep, mountain lion, coyote, bobcat, a variety of small mammals, nineteen species of bats, numerous reptiles, and over 200 species of birds including raptors and neotropical migrants, and Merriam's turkey.

Mule deer use the area above the canyon rims as summer habitat, typically browsing within and along the margins of chainings and other land treatment areas. The deer rely upon understory browse and forbs in more open areas and use the dense stands and ponderosa woodlands for cover. Mountain lions, coyotes, and other predators prey on mule deer, bighorn sheep, and a variety of small mammals.

Bighorn sheep were introduced in the Grand Wash Cliffs beginning in the early 1980s. Populations have slowly increased. Numerous predators, lack of early stage vegetation habitat and water availability are thought to be limiting population expansion. Some interchange with bighorn populations around Lake Mead is thought to occur though the extent of this movement has not been documented.

Merriam's turkeys were transplanted successfully in the area by the Arizona Game and Fish Department in the 1980s. Populations appear to be stable, though severe winters reduce survival of individuals. Pinyon pine seeds, juniper berries, and acorns are a primary component of the diet of Merriam's turkey and provide food for rodents. Many rodent species fall prey to raptors.

Turkeys require a forest mosaic including grass cover for young turkeys, insect habitat, dense trees with perches for breeding cover, older age class trees with low limbs for roosts, and wet areas with green vegetation for young turkeys. Cavity nesting birds rely on ponderosa pine and pinyon-juniper woodlands for live and dead standing trees for perching, nesting, and food storage. Cavity nesters that rely upon these habitats include screech owls, various species of woodpeckers, flycatchers, titmice, wrens, and bluebirds.

Threatened, Endangered and Sensitive Species

Several special status species are known to occur, or could possibly occur in the Shivwits region of the recreation area. Federally threatened bald eagles occur rarely on the Arizona Strip during the winter, using the area as a stop over while in migration. They do not nest in the region. There is potential Mexican spotted owl habitat within the Shivwits Region, though no spotted owls have been recorded. The federally threatened Mexican spotted owl inhabits steep, narrow, and hanging canyons with mature, uneven-aged stands of mixed-conifer and pine-oak forests.

Northern goshawk (*Accipiter gentilis*) nests have been recorded in coniferous forests on BLM administered lands on Arizona Strip, winter in lower elevations, and are likely to be found within the recreation area. The northern goshawk is listed as a sensitive species by the Southwestern Region of the USDA Forest Service and is also considered to be a species of special concern by many states, including Arizona. Although this species is a forest generalist, occurring in a variety of forest types, it does have certain habitat requirements. Large trees are necessary for nest placement, and open spaces in and below the canopy are necessary to provide sufficient space for flight and capture of prey. Thus, young dense forests are seldom used.

California condors have been introduced to the Arizona Strip and are considered an "experimental essential" population by the U.S. Fish and Wildlife Service. Potential habitat is present for these species on the Shivwits Plateau.

Nineteen species of bats exist in the Shivwits Region, and many are considered sensitive species. Bat species that have been recorded through live capture on the Shivwits Plateau include the spotted bat (*Euderma maculatum*), the Townsend western big-eared bat (*Plecotus townsendii townsendii*), and the western mastiff bat (*Eumops perotis*).

The rare Grand Canyon rose (*Rosa stellata*) is known to occur near Twin Point on the Shivwits Plateau. It grows in thin sandy-gravelly soils with limestone pebbles overlying Kaibab limestone bedrock in open Great Basin woodland vegetation. *Penstemon distans* is a sensitive plant species that occurs on the northeastern edge of the recreation area. The fire ecology of these species is unknown. In general, *Rosa* sp. resprout after low or moderate fire events, but not enough is known about either of these species to assess fire effects.

No other sensitive, threatened, or endangered plant or animal species are known to occur in the project area.

Riparian Areas

There is no perennial surface water in the area. Parashant Wash and other washes will run briefly after heavy precipitation. The Shivwits Plateau is the ultimate source of several drainages subdivided into approximately 25 smaller watersheds that flow into the Colorado River System. Water for livestock and wildlife is captured from precipitation in catchments or from surface runoff in earth tanks and reservoirs. Many natural springs exist.

Air Quality

Air quality in the Shivwits area is considered good. There is no source of air pollution in the region. Dust from vehicles and smoke from fire temporarily degrade air quality in localized areas. Grand Canyon, a Class I airshed, is nearby. Some pollutants are generated in southern California and/or Clark County, Nevada and are transported to the region by prevailing winds.

Scenic Quality

The Shivwits Plateau region of Lake Mead NRA provides visitors with spectacular views into Grand Canyon. The region provides many opportunities for visitors to view scenic vistas, open meadows, forests, and Great Basin desert communities. The scenic quality of the area, particularly the views of the Grand Canyon, can be affected by infrequent regional haze.

Cultural Resources

Archeological evidence indicates that the human occupation on the Shivwits Plateau began around 12,000 years ago. For most of the first 10,000 years, the prehistoric peoples lived in small groups. They were hunter-gatherers that moved through a series of environmental zones on an annual seasonal round. Sites from this period may contain lithic scatters, flaked stone tools, grinding slabs, and hearth features.

Ancient Puebloan influences are found by 300 B.C., and their presents continues until A.D. 1250. Throughout this period population size increases and several cultural changes take place. These include a shift from pit houses to above ground masonry structures, increased reliance on horticulture, a decrease in mobility and an increase in settlement size, and the introduction of ceramics and the bow and arrow. The Ancient Puebloans abandoned the area around A. D. 12150 for unknown reasons. Sites from this period may contain lithic scatters, flaked stone tools, ceramics, manos and metates, hearth features, house pit depressions, single and multi-room masonry ruins, and terraced fields.

The ancestors of the modern Southern Paiute dominate the area after A.D. 1250. They were primarily hunters and gatherers and practiced an annual subsistence round based on the availability of key plant resources. They would also plant small gardens near dependable water sources. There are reports of small Southern Paiute family groups practicing the traditional hunter-gatherer life way into the 1920s. Sites from this period may consist of artifact scatters containing flaked stone tools, manos and metates, ceramics, and hearth features. Rock shelters and caves were used for both habitation and storage throughout the prehistoric period. Petroglyph and pictograph sites are also occasionally found on the Shivwits Plateau.

Historic Period Euro-American occupation of the Shivwits Plateau began in the 19th century. Ranching, logging, and mining were the primary economic activities in the region. These activities have resulted in a variety of historic period resources being scattered across the landscape. These include log cabins, barns, corrals, fences, tanks, sawmills, mines, and roads.

Several of these are on the park's List of Classified Structures, and the Horse Valley Ranch (Waring Ranch) is listed on the National Register of Historic Places.

Visitor Use

The Shivwits Plateau is an extremely remote area within the Arizona Strip located on the northwest rim of the Grand Canyon. It is 90 miles south of St. George, Utah. Most of the area is without roads. Access to the area is via unpaved county roads with varying road conditions. Recreationists in the Shivwits Plateau area are known to engage in the following activities: driving for pleasure, sightseeing, hunting, car camping, mountain biking, backpacking, trapping and horse pack trips. Many visitors also travel to Twin Point and Kelly Point for their activities. Twin Point receives the most use, probably due to the ruggedness of Kelly Point road.

The area is very remote and excellent opportunities for solitude exist during much of the year because of low visitation levels. This feeling of solitude is somewhat reduced during high-use periods such as deer hunting season and summer holiday weekends. The primary access road is County Road 103. This road is generally accessible three seasons out of the year. Winter precipitation often causes the road to become impassable.

Most public use is concentrated along the primary access roads (roads 103 and 1019) within the ponderosa forests. Impacts associated with recreational use along these roads include loss of vegetation at campsites due to trampling and firewood gathering, construction of fire rings and pits, litter and creation of new roads and trails. Visitor amenities on BLM lands include directional signs, road markers and a picnic table. Lake Mead has allowed primitive campsites near their administrative site.

Data from the Pigeon Junction traffic counter indicates an average daily total of 5.85 vehicles per day on the Shivwits road. This figure is not indicative of the actual amount of traffic on any given day because of the wide seasonal variation in use. Most visits are in spring and early summer with the low occurring in January.

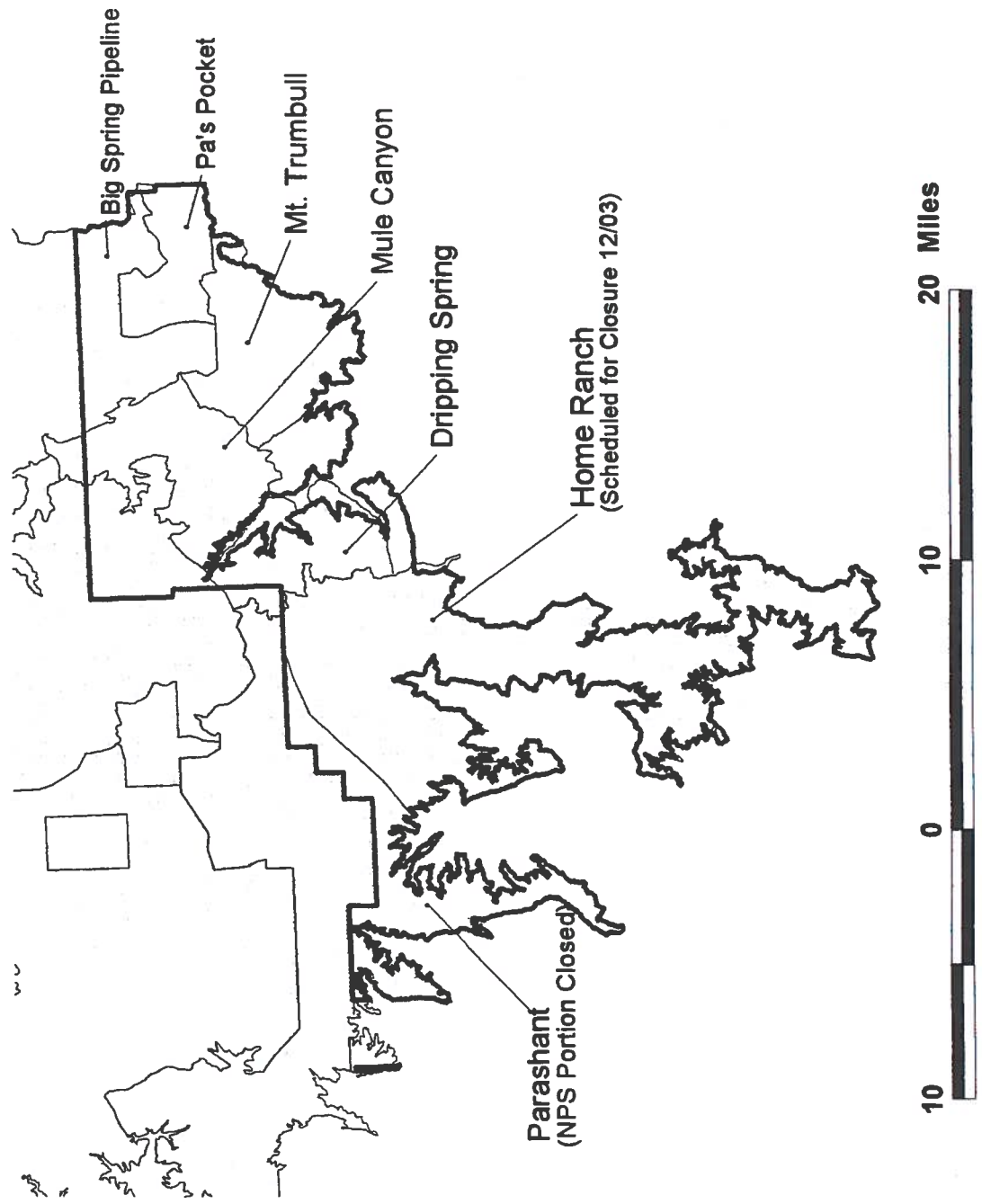
Socioeconomic Resources

There are no human communities within the boundaries of the Shivwits Plateau. Some isolated private residences are occupied on a seasonal or occasional basis. The economic base of this area is cattle ranching (Figure 3-1).

Recreation Area Operations

The area is managed jointly by Lake Mead NRA and BLM, while Grand Canyon NP is adjacent on the south and east.

Figure 3-1. Shivwits Region Grazing Allotments



Wilderness Areas

The following are areas within the proposed project area meet the criteria for wilderness or potential wilderness designation. The initial Lake Mead NRA Wilderness Proposal (1979) was not submitted for wilderness designation. Currently, Lake Mead NRA is in the process of reviewing the proposed and proposed potential wilderness areas for suitability and preparing a backcountry/wilderness management plan to formulate management strategies to ensure the protection of the wilderness resources. NPS wilderness policies require that potential and proposed wilderness areas are managed to preserve the wilderness character (*Director's Order and Reference Manual 41*).

Unit 33 - Shivwits Plateau - Proposed Potential (Grand Canyon-Parashant National Monument)

Approximately 83,980 acres are included within this unit. A diversity of activities occur in this remote section of Lake Mead, ranging from hunting to grazing. Due to a higher altitude, the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests. Therefore, it also contains a wider variety of wildlife, including mule deer. The sole population of Grand Canyon rose known to exist within the recreation area is located in this unit.

Hunting is a favorite recreational pursuit and probably accounts for the majority of the visitation to the area. Additional recreational activities include nature study, camping, exploring with four-wheel drive vehicles, and hiking the superlative rim country. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon.

Because there are (66,350) acres of land within this unit which are subject to mineral reservations, the unit only potentially meets the criteria of the Wilderness Act.

Unit boundaries follow rims, internal access roads, and recreation area boundaries. Several of the units may appear to be narrow and splintered by access roads. However, when considered along with the adjacent proposed wilderness in Grand Canyon National Park, it is apparent that these would form a significant contiguous wilderness unit.

Unit 34 - Andrus Point, Unit 35 - Whitmore Point, and Unit 36 - Lava (Grand Canyon-Parashant National Monument)

These three proposed wilderness units consist of approximately 58,430 acres in the northeast sector of the recreation area. Contained within these units are Parashant, Andrus, and Whitmore Canyons; all are precipitous side canyons of significant grandeur that drain into the Grand Canyon. The entire area is undeveloped land retaining its primeval character with the imprint of humans substantially unnoticeable and provides an opportunity for solitude or a primitive and unconfined type of recreation in a scenic setting of steep escarpments, colorful redwalls, and deep canyons.

Geologic formations and processes in evidence here may provide information on the origin of the Grand Canyon, which is of interest to the scientific and educational communities. Also of interest to these communities are the archeological sites of several Indian cultures, including the Virgin Anasazi and more recently the Paiutes.

Grazing has occurred in this region for over a hundred years and the Lake Mead enabling legislation identifies grazing as an acceptable use. Roads and tanks or water pockets that are necessary for current grazing operations are excluded from the wilderness proposal. All of the roads in this area and on the Shivwits Plateau serve dual roles providing access for recreation and for grazing support purposes.

Wilderness unit boundaries consist of road systems, recreation area boundaries, and plateau rims. Adjacent primitive areas of Grand Canyon NP were considered while deriving this wilderness proposal for Lake Mead. The areas are contiguous unit of primitive lands extending westward from the Pine Mountains across the Sanup and Shivwits Plateaus to the Grand Wash Cliffs.

SECTION 4: ENVIRONMENTAL CONSEQUENCES

Methodology

The environmental consequences section analyzes both beneficial and adverse impacts that could result from the three alternatives. Impacts are evaluated based on context, duration, intensity, and whether they are direct, indirect, or cumulative impacts.

Assumptions for Impact Analysis

This section contains the environmental impacts, including direct and indirect effects and their significance to the alternatives. The analysis of the two action alternatives assumes that vegetation would be treated, either through prescribed fires or by chemical means. It also assumes that the mitigation identified in the *Mitigation and Monitoring* section of this environmental assessment would be implemented under any of the applicable alternatives, as identified in each mitigation criteria.

Impacts are evaluated based on the most current and comprehensive scientific and social data available. All the information was not generated at Lake Mead NRA, but certain information from other areas can be used to determine potential impacts within the recreation area. Considerable information was available on the effects of fire, fire suppression and chemical treatment of vegetation. Much of the information found was generated by either the Lake Mead NRA biologists, resource management specialists whose focus is on vegetation, archaeologists, and prescribed fire specialists. Follow-up contacts with these specialists were made to assist with interpreting the information, and to provide additional information related to impacts from prescribed fire and vegetation treatment on natural resources and the visitor experience. In the absence of quantitative data, best professional judgement prevailed.

Certain impacts, such as long-term impacts to ecosystems from prescribed fire, are difficult to determine, and criteria has been developed through research and monitoring of prescribed fire effects, particularly to pinyon-juniper and ponderosa pine communities, conducted over the last decade throughout many land management agencies.

Cumulative impacts were analyzed for the alternatives and the environmentally preferred alternative. Cumulative impacts are the incremental impacts on the environment resulting from adding the alternatives to other past, present, and reasonably foreseeable future actions. This includes past prescribed burning activities, and potential actions within and outside the recreation area boundary.

Cumulative impacts will address past burn activity on the Shivwits Plateau (Table 1-1). Approximately 4,500 acres of juniper has been treated at Twin Point and about 600 acres of ponderosa pine has been burned since 1994. Site recovery is being monitored through the Fire Monitoring Handbook program and various photo-points. The results of the burns are difficult to assess since the time period since the burns is not adequate for a final assessment. Burn objectives are being met for the reduction in stems per acre and fuel consumption related objectives. Site

recovery has mixed results. Some of the juniper burn units at Twin Point have had a widespread increase in forb production and some areas have had an increase in native grass cover. Most of the seeding projects have not been successful with the exception of the Sawmill Meadow site. Burn recovery is dependent upon post burn precipitation events and there was a lack of rainfall after the Twin Burns. A large amount of sagebrush recruitment at Twin Point has occurred throughout much of the burn units. The Twin Burns are creating a mosaic of habitats. The Sawmill Meadow burn has impressive native grass recovery; this meadow is now one of the parks best examples of grass cover, much improved from pre-burn conditions of a shrub-dominated site.

There are several burns planned with the BLM on the boundary of Lake Mead NRA. However, most of the planned burns are in vegetative communities not contiguous with BLM administered lands. The ponderosa pine forests are isolated pockets, and there is much less juniper on the BLM administered lands due to chaining and other mechanical treatments. The Grand Canyon NP does not conduct prescribed burns near its western boundaries, or on the Sanup Plateau below the rim of the Shivwits Plateau. Therefore, no cumulative impacts would occur from burns within Grand Canyon NP.

While some of the information on cumulative impacts may be inexact at this time, major sources of impacts have been assessed as accurately and completely as possible, using all available data. If additional data becomes available, more detailed analysis would be performed during the completion of individual prescribed fire plans for each site.

There are several terms used within the environmental consequences section to assess the impacts of each alternative on each impact topic. Unless otherwise stated, the standard definitions for these terms are:

Negligible - the impact is at the lower level of detection; no measurable change would occur.

Minor - the impact is slight, but detectable; a small change would occur over the life of the plan.

Moderate - the impact is readily apparent; a measurable change would occur and could result in a small but permanent change.

Major - the impact is severe; a permanent measurable change of at least 15 percent over the life of the plan would occur.

Impairment - the impact would harm the entire integrity of the resource or value, whose conservation is key to the cultural or natural integrity of the recreation area, or is a resource or value needed to fulfill a specific purpose identified in the park's enabling legislation.

Localized Impact - the impact occurs in a specific site or area, individual wildlife, or the wildlife group. When comparing changes to existing conditions, the impacts are only detectable in the localized area.

Short-term - the impact occurs only during or immediately after the actual management activity.

Long-term - the impact could occur for an extended period of time after the management activity has been completed. The impact could take several years or more and could be beneficial or adverse.

Impairment Analysis

In addition to determining the environmental consequences of the alternatives, NPS Management Policies 2001, requires the analysis of potential effects to determine if actions would impair park resources. Under the NPS Organic Act and the General Authorities Act, as amended, the NPS may not allow the impairment of park resources and values, except as authorized specifically by Congress. The NPS must always seek ways to avoid or minimize, to the greatest degree practicable, adverse impacts on park resources and values. However, the laws do give the NPS management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment to the affected resources and values (Management Policies 1.4.3).

Impairment to park resources and values have been analyzed within this document. Impairment is an impact that, in the professional judgement of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. An impact would be more likely to constitute an impairment to the extent that it effects a resource or value whose conservation is necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; is the key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or is identified as a goal in the park's general management plan or other relevant NPS planning documents. An impact would be less likely to constitute an impairment to the extent that it is an unavoidable result, which cannot be reasonably further mitigated, of an action necessary to preserve or restore the integrity of park resources or values.

Cumulative Effects

Cumulative impacts were analyzed for the alternatives and the proposed action. Cumulative impacts are the incremental impacts on the environment resulting from adding the alternatives to other past, present, and reasonably foreseeable future actions. This includes potential actions within and outside the recreation area boundary. While this information may be inexact at this time, major sources of impacts have been assessed as accurately and completely as possible.

Criteria And Thresholds For Impact Analysis

This section provides a description of the related laws, regulations, and policies for each impact topic, and the methodology and thresholds used in the impact analysis. The same methodology and criteria were used for each impact topic. Certain impacts, such as visitor experience, are difficult to determine, and criteria have been developed through the visitor use and carrying capacity surveys that have been conducted within the recreation area.

Soils and Vegetation

Related Laws, Regulations, and Policies: The NPS Organic Act directs the park to conserve the scenery and the natural objects unimpaired for future generations. Soil resources will be protected by preventing or minimizing adverse potentially irreversible impacts on soils, in accordance with NPS Management Policies.

NPS-77 specified objectives for each management zone for soil resources management. These management objectives are defined as: (1) natural zone - preserve natural soils and the processes of soil genesis in a condition undisturbed by humans; (2) cultural zone - conserve soil resources to the extent possible consistent with maintenance of the historic and cultural scene and prevent soil erosion wherever possible; (3) park development zone - ensure that developments and their management are consistent with soil limitations and soil conservation practices; and, (4) special use zone - minimize soil loss and disturbance caused by special use activities, and ensure that soils retain their productivity and potential for reclamation.

Zones within the recreation area have been designated in the Lake Mead NRA General Management Plan, which provides the overall guidance and management direction for Lake Mead NRA.

NPS Management Policies defines the general principles for managing biological resources as maintaining all native plants and animals as part of the natural ecosystem. When NPS management actions cause native vegetation to be removed, then the NPS will seek to ensure that such removals will not cause unacceptable impacts to native resource, natural process, or other park resources.

Exotic species, also referred to as non-native or alien, are not a natural component of the ecosystem. They are managed, up to and including eradication, under the criteria specified in Management Policies and NPS-77.

Impact Indicators, Criteria, and Methodology

Negligible: Impacts have no measurable or perceptible changes in soil structure and occur in a relatively small area. Impacts have no measurable or perceptible changes in plant community size, integrity, or continuity.

Minor: Impacts are measurable or perceptible but localized in a relatively small area. The overall soil structure would not be affected. Impacts are measurable or perceptible and localized within a relatively small area. The overall viability of the plant community would not be affected and, if left alone, would recover.

Moderate: Impacts would be localized and small in size, but would cause a permanent change in the soil structure in that particular area. Impacts would cause a change in the plant community (e.g. abundance, distribution, quantity, or quality); however, the impact would remain localized.

Major: Impact to the soil structure would be substantial, highly noticeable, and permanent. Impacts to the plant community would be substantial, highly noticeable, and permanent.

Impairment: For this analysis, impairment is considered a permanent change in a large portion of the overall acreage of the park, affecting the resource to the point that the park's purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgement prevailed.

Wildlife

Related Laws, Regulations, and Policies: The NPS Organic Act, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the NPS to mean native animal life should be protected and perpetuated as part of the recreation area's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible. The restoration of native species is a high priority. Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity and ecological integrity of plants and animals.

The recreation area manages and monitors wildlife cooperatively on the Shivwits Plateau with the Arizona Game and Fish Department and the BLM.

Impact Indicators, Criteria, and Methodology

The following are standards used by the NPS in interpreting the level of impact to wildlife:

Negligible impacts: No species of concern is present; no impacts or impacts with only temporary effects are expected.

Minor impacts: Nonbreeding animals of concern are present, but only in low numbers. Habitat is not critical for survival; other habitat is available nearby. Occasional flight responses by wildlife are expected, but without interference with feeding, reproduction or other activities necessary for survival.

Moderate impacts: Breeding animals of concern are present; animals are present during particularly vulnerable life-stages, such as migration or winter; mortality or interference with activities necessary for survival expected on an occasional basis, but not expected to threaten the continued existence of the species in the park.

Major impacts: Breeding animals are present in relatively high numbers, and/or wildlife is present during particularly vulnerable life stages. Habitat targeted by actions has a history of use by wildlife during critical periods, but there is suitable habitat for use nearby. Few incidents of mortality could occur, but the continued survival of the species is not at risk.

Impairment: The impact would contribute substantially to the deterioration of natural resources to the extent that the park's wildlife and habitat would no longer function as a natural system. Wildlife and its habitat would be affected over the long-term to the point that the park's purpose (Enabling Legislation, *General Management Plan*, *Strategic Plan*) could not be fulfilled and resource could not be experienced and enjoyed by future generations.

When these criteria were not applicable, standard definitions for degree of change related to existing conditions were used. In the absence of quantitative data, best professional judgement prevailed.

Threatened, Endangered and Sensitive Species

Related Laws, Regulations, and Policies: Section 7 of the Endangered Species Act mandates all federal agencies to determine how to use their existing authorities to further the purposes of the Act to aid in recovering listed species, and to address existing and potential conservation issues. Section 7(a)(2) states that each federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Management Policies directs the parks to survey for, protect, and strive to recover all species native to National Park System units that are listed under the Endangered Species Act (4.4.2.3). It sets the direction to meet the obligations of the Act. Management Policies also directs the NPS to inventory, monitor, and manage state and locally listed species, and other native species that are of special management concern to the parks, to maintain their natural distribution and abundance.

The General Management Plan designated the Shivwits Plateau as a natural zones, and areas with known habitat or potential habitat for rare, threatened, or endangered species were further protected by placement in the environmental protection or outstanding natural feature subzone of the natural zone. Management of these zones focuses on the maintenance of isolation and natural process, and restoration of natural resources.

Impact Indicators, Criteria, and Methodology

The Endangered Species Act defines the terminology used to assess impacts to listed species as follows:

No effect: The appropriate conclusion when the action agency determines that its proposed action would not affect a listed species or designated critical habitat.

Is not likely to adversely affect: The appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

Based on the best judgement, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

Is likely to adversely affect: The appropriate finding if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial. In the effect the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action “is likely to adversely affect” the listed species. If incidental take is anticipated to occur as a result of the proposed action, an “is likely to adversely affect” determination should be made.

Is likely to jeopardize proposed species/adversely modify proposed critical habitat – (Impairment): The appropriate conclusion when the action agency or the U.S. Fish and Wildlife Service identify situations in which the proposed action is likely to jeopardize the continued existence of a proposed species or adversely modify the proposed critical habitat.

Riparian Areas

Related Laws, Regulations, and Policies: Riparian areas are protected under the same guidelines as soils, vegetation, and wildlife.

Impact Indicators, Criteria, and Methodology

Negligible: Impacts have no measurable or perceptible changes and occur in a relatively small area. Impacts have no measurable or perceptible changes in riparian plant community size, integrity, or continuity.

Minor: Impacts are measurable or perceptible but localized in a relatively small area. The overall riparian area would not be affected. Impacts are measurable or perceptible and localized within a relatively small area. The overall viability of the riparian community would not be affected and, if left alone, would recover.

Moderate: Impacts would be localized and small in size, but would cause a permanent change in the riparian community in that particular area. Impacts would cause a change in the riparian plant community (e.g. abundance, distribution, quantity, or quality); however, the impact would remain localized.

Major: Impact to the riparian area would be substantial, highly noticeable, and permanent. Impacts to the riparian plant community would be substantial, highly noticeable, and permanent.

Impairment: For this analysis, impairment is considered a permanent change, affecting the resource to the point that the park’s purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgement prevailed.

Wilderness Areas

Related Laws, Regulations, and Policies: The Wilderness Act (P.L. 88-577) established a national Wilderness Preservation System to ensure that federally owned areas designated by Congress as wilderness could be managed for the enjoyment and use for all Americans in a manner that will leave them unimpaired for future generations. Resource Management Guidelines (NPS-77), the 1999 NPS Directors Order 41 (DO-41), Wilderness Preservation and Management, and the 2000 NPS Management Policies specifically state that the term wilderness includes the categories of *designated, proposed, potential, recommended, study areas, and suitable*, and that wilderness policies apply in these areas regardless of the category. While Lake Mead NRA does not have designated wilderness areas, there are areas considered suitable and potential wilderness, and these are managed to preserve the character of the wilderness resource.

Impact Indicators, Criteria, and Methodology

Negligible: There would be no measurable change, and the wilderness character of the area would not be altered. The impact is at the lower level of detection.

Minor: The impact is slight, but detectable during only a short duration; a small change would occur but it would not alter the wilderness character of the area.

Moderate: The impact is readily apparent; a measurable change would occur and could result in a small but temporary change to the wilderness character. The change would be longer in duration than a minor impact, but still considered a temporary change.

Major: The impact is severe; a permanent measurable change would occur to the portions of the wilderness area. The wilderness character of impacted areas could be altered in a large area for an extended period of time.

Impairment: The impact would harm the entire integrity of the wilderness resource, and permanently alter the wilderness character, making the area unsuitable for wilderness designation.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgement prevailed.

Grazing

Related Laws, Regulations, and Policies: The enabling legislation of Lake Mead NRA permitted the Secretary to provide for grazing, "subject to such limitations, conditions, or regulations as he may prescribe, and to such extent as will not be inconsistent with either the recreational use of the primary use of that portions of the area heretofore withdrawn for reclamation purposes." NPS Management Policies states that livestock use, as specifically

authorized by a park's enabling legislation, will be allowed only where it would not cause unacceptable impacts to a park's resources, values, or purposes (8.6.8). The Parashant Interdisciplinary Management Plan recognized that grazing could occur but would be managed to provide rest on the allotments due to fire and vegetation treatments.

Impact Indicators, Criteria, and Methodology

Negligible: No impacts to grazing would occur.

Minor: The impact to grazing is slight. Small portions of grazing allotments would be temporarily closed to grazing during treatment and restoration activities.

Moderate: The impact to grazing is readily apparent. Grazing allotments would be temporarily closed to grazing during treatment and restoration activities, or due to unsuitable conditions.

Major: The impact to grazing is severe. Grazing allotments would be closed for longer periods of time due to treatment and restoration activities, or due to unsuitable conditions.

Impairment: For this analysis, impairment is considered a permanent change, affecting the resource to the point that the park's purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgement prevailed.

Air Quality

Related Laws, Regulations, and Policies: Lake Mead NRA is designated as a Class II Air Quality area under the Clean Air Act. The main purpose of this act is to protect and enhance the nation's air quality to promote the public health and welfare. The act establishes specific programs to provide protection for air resources and values, including the program to prevent significant deterioration of air quality in clean air regions of the country. Although Lake Mead NRA is designated as a Class II Air Quality area, the park strives to maintain the highest air quality standards, and project work within the recreation area is completed in accordance with regional standards. However, the recreation area does not possess sufficient autonomous authority to address issues of air quality improvements when air pollution originates outside the boundaries. NPS Management Policies direct parks to seek to perpetuate the best possible air quality to preserve natural and cultural resources, sustain visitor enjoyment, human health, and preserve scenic vistas (4.7). Parks are directed to comply with all federal, state, and local air quality regulations and permitting requirements.

Impact Indicators, Criteria, and Methodology

There are four impact categories relevant to air quality issues: negligible, minor, moderate and major. Each category is discussed below relative to potential airborne pollution impacts from the

alternatives on park resources and human health. "Impairment" is not considered an impact category, because an air quality impact could be considered "impairment" at the minor, moderate or major level, depending on a variety of factors from a park's enabling legislation, management objectives, or presence of sensitive resources.

Negligible impacts - There is no visible smoke. Ambient air quality concentrations are well below (less than 60 percent) of standards (National Ambient Air Quality Standards (NAAQS) or EPA's Air Quality Index).

Minor impacts - Smoke is visible during brief periods of time. Dust from use the dirt roads is visible during brief periods. Mitigation is able to alleviate the impacts. Ambient air quality concentrations are well below (less than 60 percent) of standards (NAAQS or EPA's Air Quality Index).

Moderate impacts - Smoke is visible during extended periods. Dust from the use of dirt roads is visible for an extended area. Mitigation is able to alleviate the impacts. Ambient air quality concentrations approach (between 60 percent and 100 percent) of standards (NAAQS or EPA's Air Quality Index).

Major impacts - Smoke is easily detectable for extended periods of time in a large area. Dust from the use of dirt roads and equipment is visible for an extended period for an extended amount of time, and mitigation is unable to alleviate the conditions. Ambient air quality concentrations equal or exceed the standards (NAAQS or EPA's Air Quality Index).

Scenic Quality

Related Laws, Regulations, and Policies: The enabling legislation of Lake Mead NRA specifically addresses the preservation of the scenic features of the area. The NPS manages the natural resources of the park, including highly valued associated characteristics such as scenic views, to maintain them in an unimpaired conditions for future generations (Management Policies 4).

Since impacts on scenic quality are difficult to assess, best professional judgement prevailed in the evaluation of impacts.

Cultural Resources

Related Laws, Regulations, and Policies: Numerous legislative acts, regulations, and NPS policies provide direction for the protection, preservation, and management of cultural resources on public lands. Further, these laws and policies establish what must be considered in general management planning and how cultural resources must be managed in future undertakings resulting from the approved plan regardless of the final Alternative chosen. Applicable laws and regulations include the NPS Organic Act (1916), the Antiquities Act of 1906, the National Historic Preservation Act of 1966 (1992, as amended), the National Environmental Policy Act of 1969, the National Parks and Recreation Act of 1978, the Archeological Resources Protection

Act of 1979, the Native American Graves Protection and Repatriation Act of 1990, and the Curation of Federally Owned and Administered Archeological Collections (1991).

Applicable agency policies relevant to cultural resources include Chapter 5 of NPS Management Policies, and the Cultural Resource Management Guideline (DO-28), as well as other related policy directives such as the NPS Museum Handbook, the NPS Manual for Museums, and Interpretation and Visitor Services Guidelines (NPS-26).

In addition, consultation with Native American groups is required under Executive Memorandum of April 29, 1994, Government to Government Relations with Native American Tribal Governments; Executive Order 13007 of May 24, 1996, Indian Sacred Sites; and, Executive Order of May 14, 1998, Consultation and Coordination with Indian Tribal Governments.

Impact Indicators, Criteria, and Methodology

Impacts on cultural resources were developed based on existing conditions, current regulations, and likely development trends. The inventory of archaeological resources in the park is largely incomplete. For purposes of assessing impacts, all unrecorded resources are considered potentially eligible for listing on the National Register of Historic Places.

The park's inventory of standing structures and cultural landscapes is relatively complete, however, many structures and landscapes still require evaluation to determine their eligibility for listing on the National Register of Historic Places. For purposes of assessing potential impacts to these properties, unevaluated structures and landscapes are assumed to be potentially eligible.

Under section 106, only historic resources that are eligible or are listed on the National Register of Historic Places are considered for impacts. An impact, or effect, to a property occurs if a proposed action would alter in any way the characteristic that qualify it for inclusion on the register. If the proposed action would diminish the integrity of any of these characteristics, it is considered to be an adverse effect.

For the purposes of this document, the level of impacts to cultural resources was accomplished using the following criteria:

Negligible impacts: No potentially eligible or listed properties are present; no direct or indirect impacts.

Minor impacts: Potentially eligible or listed properties are present; no direct impacts or impacts with only temporary effects are expected.

Moderate impacts: Potentially eligible or listed properties are present; indirect impacts or, in the case of structures, where activity is limited to rehabilitation conducted in a manner that preserves the historical and architectural value of the property.

Major impacts: Potentially eligible or listed properties present; direct impacts including physical destruction, damage, or alternation of all or part of a property. Isolation of a property from or alteration of the character of a property's setting when that character contributes to its eligibility, including removal from its historic location. Introduction of visual, audible, or atmospheric elements that are out of character with the property of alter its setting. Neglect of a property resulting in its deterioration or destruction (36 CFR 800.5).

Impairment: Loss, destruction, or degradation of a cultural property, resource, or value to the point that it negatively affects the park's purpose and visitor experience.

In the absence of quantitative data concerning the full extent of actions under a proposed alternative, best professional judgement prevailed.

Visitor Use

Related Laws, Regulations, and Policies: Visitor use in parks is authorized in the NPS Organic Act and managed under the NPS Management Policies under Chapter 8, "Use of Parks" that includes commercial as well as public use. Recreational purposes and activities authorized at Lake Mead NRA are more specifically defined in Section 4 of the area's enabling legislation, Public Law 88-639.

Impact Indicators, Criteria, and Methodology

Negligible impacts - No impact to the visitor experience or only temporary effects are expected. Little noticeable change in visitor experience or in the defined indicators of visitor satisfaction or behavior.

Minor impacts: Desired visitor experience is changed, but without appreciably limiting or enhancing critical characteristics of the experience. Visitor satisfaction would remain stable.

Moderate impacts: Critical characteristics of the desired experience are changed or the number of participants engaging in an activity is altered. Visitor satisfaction would begin to decline.

Major impacts: Eliminates, detracts from or greatly enhances multiple critical characteristics of the desired experience or greatly reduces or increases participation. Visitor satisfaction would decline substantially.

Impairment: The impacts to the visitor satisfaction the prescribed fire program would be so substantial that the park's purpose of providing for visitor use and enjoyment could not be fulfilled.

Safety

Related Laws, Regulations, and Policies: *The Federal Wildland Fire Management Policy and Program Review, 1995*, provides fire policies related to safety. The guiding principles are

fundamental and establish firefighter and public safety as the first priority in every fire management activity.

Impact Indicators, Criteria, and Methodology

Negligible Impacts: The impact to personnel and visitor safety is not measurable or perceptible.

Minor Impacts: The impact to personnel and visitor safety is slight and temporary, but not sufficient to cause a permanent change in accident rates and can be immediately controlled by management actions in a timely manner.

Moderate Impacts: The impact to personnel and visitor is slight and temporary, but could create a slight permanent increase in accident rates. The safety of park personnel and visitors can not be controlled immediately by park management, but control would occur within 24 hours.

Major Impacts: The impact to personnel and visitor safety is sufficient to cause a permanent change in accident rates at existing low accident locations.

Impairment: The impacts to personnel and visitor safety would be so substantial that the park's purpose of providing for visitor use and enjoyment, and the park's mandate for a safe working environment, could not be fulfilled.

Environmental Consequences

Alternative A – No Action: No Treatment of Vegetation (No Prescribed Fire, Mechanical, or Chemical Treatments)

Impacts of Alternative A to Soils and Vegetation: The exclusion of fire as an ecosystem process would prevent a major natural cause of disturbance in the sagebrush scrub and pinyon-juniper woodlands of the Shivwits Plateau. Without the thinning of vegetation that is a natural result of the fire process, the success of new saplings may be prevented as they would be outcompeted by older, thicker stands of vegetation. This phenomenon could seriously impact the health of the sagebrush and pinyon-juniper woodlands. In addition, since pinyon-juniper outcompetes grasses and forbs, suppression activities could result in the prevention of the invasion of forbs and grasses, reducing ground cover, which could lead to increased soil erosion. The exclusion of fire may result in an overgrowth of sagebrush, which could threaten and/or outcompete other vegetation, resulting in a dominant monoculture with little biodiversity and no understory. Lack of understory vegetation can result in an increase in soil erosion. According to NPS biologists, in many of the sagebrush areas on the Shivwits Plateau, this pattern is already evident.

Monitoring has shown that past fire suppression activities have resulted in even-aged ponderosa stands. A stand of ponderosa pines that is experiencing relatively the same growth patterns at the same time can stunt one another's growth and become very dense and thick ("dog-hair" thickets), and dangerous accumulations of forest floor litter (hazardous fuels) can occur. This alternative

would prevent the thinning of these dog-hair thickets, as well as the success of new saplings, impacting the health of the ponderosa stands.

The accumulations of forest floor litter in ponderosa woodlands would continue, increasing fire danger, which could eventually result in a large, catastrophic wildland fire. An intense fire in ponderosa woodlands, fueled by forest floor litter and dense, even-aged ponderosa thickets, could cause crown fires, resulting in stand destruction, destruction of the seed base, and a reduction of ground cover, increasing soil erosion and potentially impacting the health of the ponderosa population on the Shivwits Plateau.

High intensity fires could result from this alternative and would result in increased soil erosion.

Cumulative Impacts: Areas previously treated would recover and would provide a mosaic type community that could add to increased vegetative diversity in over 5,000 acres of the Shivwits Plateau. Lack of future treatment in the remaining acres could result in the buildup of hazardous fuels and unnatural, monoculture conditions in many of the vegetation communities, such as the ponderosa woodlands, the sagebrush population and the pinyon-juniper forests. The buildup of hazardous fuels could contribute to a large, catastrophic wildland fire that has the potential to destroy entire vegetative communities. These factors could lead to long-term impacts of the vegetative ecosystem on the Shivwits Plateau, which could in turn impact wildlife habitat and increase soil erosion.

Conclusion: Lack of vegetative treatment in the area would lead to an increase in ground cover and hazard fuel buildup, which could lead to increased fire danger. If fire occurs in areas with increased hazard fuel loads, fires would be more intense, harder to control, with more chance of escape and damage to natural and cultural resources. This could create moderate to major impacts to the plant community and the soil structure.

In addition, lack of treatment in the ponderosa woodlands would prevent the thinning of dog-hair thickets and lead to unhealthy densities of ponderosa pine. This would disrupt the natural ecosystem necessary to promote a healthy ponderosa community.

Past suppression and other human-caused disturbance has led to a monoculture community of sagebrush and pinyon-juniper in large portions of the Shivwits Plateau, with low biodiversity and limited amounts of grasses and forbs resulting in an increase in soil erosion. This pattern would likely remain under this alternative and could eventually lead to major impacts to the soil and vegetative resources in specific areas of the Shivwits Plateau. No impairment would occur as a result of the impacts from this alternative.

Impacts from Alternative A to Wildlife: Because no vegetative treatment would occur in the area, vegetation monocultures could increase throughout the region and grasses and forbs would not reinvade the area, decreasing the quality and value of wildlife habitat and biodiversity in the area. An increase in vegetation monocultures and a decrease in biodiversity resulting from suppression activities could create moderate to major adverse impacts to the turkey population.

Wildlife that would not ordinarily be able to migrate away from fire areas would be protected since no prescribed burning would occur under this alternative. Since suppression activities would contribute to the buildup of hazardous fuel materials over time, a catastrophic wildland fire could result, resulting in wildlife mortality and moderate to major adverse impacts to habitat.

Cumulative Impacts: Areas previously treated by burning would continue to provide a mosaic habitat for wildlife. The increase of vegetation monocultures and decrease in biodiversity resulting from the absence of fire in the remaining areas could impact the quality and availability of wildlife habitat and decrease wildlife biodiversity in the area. If neighboring BLM administered lands and Grand Canyon NP followed a similar course of action, the overall health of the Colorado Plateau in this region could be detrimentally impacted by a decrease in biodiversity.

Conclusion: The lack of vegetative treatments could contribute to increased vegetation monocultures and decreased biodiversity, adversely impacting wildlife habitat.

The lack of vegetative treatments could contribute to an increase in hazard fuel buildup, which could result in a large, difficult to manage wildland fire that could impact wildlife habitat and cause animal mortality. If neighboring land management agencies followed a similar course of action, the result could be a decrease in diversity of wildlife, and lead to moderate to major negative impacts to the wildlife habitat. The impacts associated with this alternative would not cause impairment to the wildlife and wildlife habitat of this region.

Impacts from Alternative A to Sensitive, Threatened and Endangered Species:

This Alternative could lead to thick undergrowth and increase the potential for wildland fires in the region. If a wildland fire occurred and suppression actions failed, some habitat which is considered potential threatened and endangered species habitat, could be destroyed.

The threatened bald eagle is a rare winter visitor to the Shivwits area and does not nest in the region. There would be no effect under this alternative.

Potential habitat for the threatened Mexican spotted owl occurs on the Shivwits Plateau, though no occurrence has been recorded. If a high-frequency fire occur, portions of the potential habitat could be damaged or destroyed by burning and suppression activities. Generally, these species would relocate outside the burn area. If fires occur during nesting season, there may be mortality at nesting sites. However, it is unlikely that this species would be adversely impacted because it is not known to occur in the area.

Northern goshawk nests have been recorded in coniferous forests on BLM administered lands on the Arizona Strip. If a large wildland fire occurred and containment efforts failed, some habitat could be adversely impacted.

No threatened or endangered plants occur on the Shivwits Plateau, though two rare plants are known to exist in the region, the Grand Canyon rose (*Rosa stellata*) and *Penstemon distans*.

Neither would be impacted by this alternative. Fires that escape containment could burn areas where these species exist, potentially destroying some plants.

Cumulative: Past actions have not shown to impact threatened and endangered species. No cumulative impacts would occur to threatened and endangered species.

Conclusion: Some potential threatened and endangered species habitat may be adversely impacted by a build-up of hazardous fuel, which could lead to high-intensity wildland fires.

Threatened and endangered wildlife species in the area generally either do not use the area as prime habitat. Therefore, it is likely that threatened and endangered wildlife species in the area would not be impaired from the impacts of this alternative.

Individual specimens of the two rare plants would not be impaired from the impacts associated with this alternative.

Impacts from Alternative A to Riparian Areas: Riparian areas are generally able to repel fires due to their cool, moist microclimate, however, hazard fuel build-up could impact these resources. If a wildland fire would occur, and suppression methods fail, high intensity fire may consume streamside vegetation or upslope cover and would have temporary minor to moderate adverse impacts on riparian communities, including loss of vegetative cover, and increased erosion, which may lead to decreased water quality.

Cumulative Impacts: Past actions have not impacted riparian areas. No cumulative impacts would occur to riparian areas.

Conclusion: If a wildland fire occurs near these areas and suppression methods fail, temporary minor to moderate adverse impacts may occur to riparian areas, including loss of vegetative cover and increased erosion. Overall, riparian areas would not be impaired as impacts would be localized to individual riparian areas.

Impacts from Alternative A to Wilderness Areas: The lack of fuel management activities may lead to increased vegetative ground cover and buildup of hazardous fuels, which could result in a large, intense, difficult to manage wildland fire. Such a fire has the potential to destroy many acres of potential wilderness. These impacts would be moderate to major, as they would be temporary, as the area would eventually be restored through natural processes or management-directed rehabilitation.

Cumulative Impacts: Past actions have temporarily impacted wilderness areas through short-term closures, smoke, and the appearance of burned areas. However, recovery of the areas has led to a more natural appearance and a diversity of vegetative communities, and have not resulted in long-term cumulative impacts to the wilderness or wilderness character. Overtime, without fuel management activities on the Shivwits Plateau there would be a continued accumulation of fuels that could eventually lead to a large wildland fire that could potentially alter the character of the wilderness on a temporary basis creating moderate to major adverse impacts.

Conclusion: If containment methods fail, a large wildland fire could result, potentially destroying many acres of wilderness and adversely impacting the wilderness area itself. This would be considered a major temporary impact to the wilderness resource. However, the wilderness areas would recover and the wilderness character would not be permanently impaired.

Impacts from Alternative A to Grazing: Permittees would not be required to remove their cattle from the allotments due to prescribed burning. However, if a high intensity wildland fire occurs, and it escapes initial attack efforts, cattle would need to be removed from the burn area until it recovers, which could be a period of at least two years. Some livestock may be unable to migrate away from the fire and livestock mortality may occur.

Pinyon-juniper and sagebrush outcompete grasses and forbs. As such, the lack of prescribed burn activities could promote vegetative monocultures of pinyon-juniper and sagebrush, which would prevent grasses and forbs from reestablishing, potentially decreasing the size and availability of grazing areas, and impairing grazing practices on the Shivwits Plateau.

Cumulative Impacts: Past prescribed burning has not impacted cattle grazing. Suppression activities would promote vegetative monocultures of pinyon-juniper and sagebrush, which would prevent grasses and forbs from reestablishing, potentially decreasing the size and availability of grazing areas, impacting grazing activities on the Shivwits Plateau.

Conclusion: Cattle would not have to be moved due to the lack of prescribed burning. It may be necessary to move cattle if a wildland fire occurs, until the natural resources have recovered, resulting in temporary adverse impacts to grazing. Suppression activities may prevent grasses and forbs from reestablishing in the area, decreasing grazing areas and potentially creating major impacts grazing activities in the area, including the closure of some allotments. No impairment to grazing operations would occur as a result of the impacts from this alternative.

Impacts from Alternative A to Air Quality: Since no prescribed burning would occur, air quality would not be impacted from this activity. However, due to the natural rate of fuel accumulation, uncontrollable, infrequent wildland fires could occur. These fires would create smoke that would impact air quality and the visual resources of Lake Mead NRA, and adjacent BLM and NPS administered lands. Depending on prevailing winds and other weather factors, fine organic and inorganic matter (particulate matter), such as ash, dust, and soil, less than 10 microns in diameter could be elevated locally on a temporary basis. Particulate matter less than 10 microns can collect in human lungs and be hazardous to health. Smoke from fires on the Shivwits Plateau could create temporary moderate to major impact visual resources and air quality at Grand Canyon NP, a Class I airshed.

Cumulative Impacts: Haze is a major factor contributing to the derogation of air quality in the Colorado Plateau. Most haze originates from outside the area, from urban areas. The lack of prescribed burning on the Shivwits Plateau could potentially lead to conditions suitable for large, uncontrollable wildland fires. This could temporarily add smoke to the haze conditions that occur in the area, and impact the air quality in a large area of the Colorado Plateau. How large an area

is impacted depends on the wind and weather factors, but there is the potential for major impacts to the air quality.

Conclusion: The wildland fires that could occur under this policy could result in adverse impacts to air quality that would be longer in duration, more intense, and encompass larger areas than those impacted by a prescribed fire program. If wildland fires occur, air quality in the region would be temporarily impacted from smoke, and this could add to the haze conditions that periodically exist in the region. There would be no impairment to air quality as a result of the impacts from this alternative.

Impacts from Alternative A to Scenic Quality: The lack of a vegetative treatment program could create even-aged vegetation stands, impacting the scenic appearance with an unnatural view that looks as if it has been purposefully manipulated by humans. If a wildland fire does occur as a result of the natural rate of fuel accumulation, the smoke from the fire would create temporary impacts to the scenic quality of the region.

Cumulative Impacts: Past burning activities have reduced the vegetative monoculture of pinyon/juniper habitat and led to increased biodiversity, improving the scenic quality of the burned areas in the long-term. Burning within ponderosa pine stands has opened the area allowing for more growth of the larger trees and this has shown to improve the scenic quality of the area over time. If prescribed burning does not occur on the Shivwits Plateau, the overall scenic quality of the area could be impacted, especially if an uncontrollable wildland fire occurs as a result of the fuel accumulation. A large wildland fire would create visual impacts from burned vegetation, until the area recovers, which may take several years depending on weather conditions. If neighboring areas do not implement a prescribed burn program, there may be more risk for a wildland fire over a larger area, thus magnifying the potential cumulative visual impacts.

Conclusion: The lack of prescribed burns could impact the scenic quality by producing an unnatural viewshed that appears to be manipulated by humans. An uncontrollable wildland fire could occur as a result of the fuel accumulation, which could impact the scenic quality of the area temporarily until recovery occurs. There would be no permanent impairment to the scenic quality of the area from the impacts associated with this alternative.

Impacts from Alternative A to Cultural Resources: There would be no impact from cultural resources from prescribed burns since there would be no burns under this alternative. However, if a wildland fire occurred and containment failed, cultural resources could be damaged by high intensity fires that escape initial attack efforts. High intensity fires could shatter lithics and ground stone, warp ceramics and burn-off paint, and burn fibrous, wood, and pollen material. These fires could also lead to soil erosion, which could expose or damage cultural sites. Trampling and ground disturbance from suppression activities related to wildland fires could impact unrecorded and unknown sites.

Cumulative: Minor impacts to cultural resources have occurred as a result of the past burning activities. If a large wildland fire occurred on the Shivwits Plateau, there could be an irretrievable loss of cultural resources.

Conclusion: If a wildland fire resulted from the build up of fuel, suppression activities would impact soils and vegetation, and could potentially increase soil erosion and impact previously unexposed cultural resources. Trampling and ground disturbance from suppression activities could impact cultural resources. If suppression activities fail, high intensity fires could impact cultural and historic resources. The impact could be moderate to major depending on the types of properties present. If sites are burned under these circumstances, they could be permanently destroyed, leading to impairment of these resources.

Impacts from Alternative A to Visitor Use: Visitors would not be restricted due to prescribed burning activities. However, if a wildland fire occurred, visitors would be temporarily restricted from the fire areas and the visitor experience could be altered due to the post-fire conditions. This could result in moderate to major impacts to visitor use, in the burn area, until recovery or restoration occurs.

Cumulative: Since any impacts to visitor use would be short-term, no cumulative impacts would occur to visitor use.

Conclusion: No prescribed burning would occur, therefore visitor access would not be restricted due to prescribed burns. However, visitor access could be temporarily restricted to areas due to wildland fires. This could create minor to major impacts to the visitor experience depending on the intensity of the wildland fire, the area it covered, and the recovery time. Since the burned area would recover over time, there would be no impairment to visitor use due to the impacts from this alternative.

Impacts from Alternative A to Safety: The lack of a vegetative treatment program would continue to allow the accumulations of fuels, which could eventually result in a large, intense, difficult to manage wildland fire that could threaten the safety of fire crews, even though they would follow the strict fire management guidelines.

In severe cases where containment is unachievable, the safety of adjacent land owners could be threatened. However, fire policies dictate the procedures for notification, and land owners would be evacuated if the potential for the spread of the wildland fire is indicated.

Cumulative Impacts: No cumulative impacts would occur to safety.

Conclusion: The lack of a vegetation treatment program could result in a dangerous buildup of fuel that may cause a large wildland fire that could threaten the safety of the fire crews, as well as adjacent landowners. This could create moderate to major adverse impacts to the safety of crews and landowners during wildland fire situations. With established safety guidelines, the impacts from this alternative is not expected to result in impairment.

Impacts from Alternative A on Recreation Area Operations: The lack of a vegetative treatment program could result in a large, difficult to manage wildland fire. The recreation area would need to dispatch additional fire crew and equipment to the site. Assistance may be required from other agencies or parks.

Cumulative Impacts: No cumulative impacts would occur to recreation area operations.

Conclusion: If a wildland fire occurred, the recreation area would need to dispatch additional personnel and equipment to the site and assistance from other agencies may be needed. There would be no impairment to recreation area operations from the impacts associated with this alternative.

Alternative B— Prescribed Fire 5-year Plan

Impacts from Alternative B to Soils and Vegetation: Prescribed fires would reintroduce a necessary major cause of disturbance in the sagebrush scrub and pinyon-juniper woodlands of the Shivwits Plateau. The thinning process that is a natural result of fire would allow successful new growth and the reestablishment of grasses and forbs, improving the overall health of the pinyon-juniper and sagebrush communities. In addition, fires would reduce monocultures and improve biodiversity in sagebrush communities by thinning out overgrown sagebrush and allowing understory growth, which decreases soil erosion and improves overall health of the vegetative ecosystem. Fires can also benefit soils by the return of nutrients and organic matter in the form of ash.

In prescribed fire zones a natural fire cycle would reestablish. Periodic stand-replacing or type-converting fires would be prescribed, allowing shrub and pinyon-juniper woodland communities to return to early successional stages. Vegetation, including grasses, sagebrush, pinyon-juniper, and ponderosa pine would burn, allowing new growth, creating uneven-aged stands, which could lead to a more healthy vegetation community. Grasses and forbs would dominate sites after a burn. In optimum situations, grasses and forbs would be followed by the re-establishment of shrubs followed by pinyon-juniper woodlands. The successional process would take decades and the progression of seral stages and the occurrence of prescribed fires would provide a mosaic of vegetation and more accurately reflect natural processes, improving the overall health of the vegetative ecosystem.

Prescribed fires would reduce forest floor litter and prevent excessive buildup of hazardous fuels, which could prevent a large, difficult to manage wildland fire from occurring.

Prescribed fires that burn out of prescription by burning intensely or too hot, could result in scorching of presettlement ponderosa pine and could potentially lead to crown fires. These high intensity fires have been shown to damage or kill ponderosa pine and result in park managers not meeting their burn objectives. These burns could potentially lead to moderate to severe impacts, resulting in long-term detrimental impacts to the ponderosa pine community. Mitigation measures would reduce the risk of these high intensity fires.

Exotic species, such as cheat grass, could move into areas after burns, potentially outcompeting native grasses and forbs. Mitigation measures for exotic plant control would be implemented to prevent adverse impacts to native species.

Fires could result in some soil erosion and run-off, depending on amount of vegetation burned, soil, slope, and fire frequency. High intensity fires could result in pockets of soil sterilization which could take several years to recover. High intensity fires are likely in juniper areas and could occur in ponderosa areas that burn out of prescription. Most impacts to soils would be short-term. In past prescribed burns, grasses and forbs have reestablished in the most burn areas and have provided ground cover, decreasing erosion.

Trampling and ground disturbance from prescribed fire activities could adversely impact vegetation and soils, however impacts would be localized to high-traffic areas.

Mechanized treatment would occur prior to burning in the juniper areas of Twin Mechanical North and South, and Kelly Mechanical East and West. Postsettlement juniper would be cut with chainsaws and tree shearers in an effort to build fuel accumulation to produce the moderate to high intensity fires which are necessary for effective treatment in juniper communities.

Cumulative Impacts: Past burning activities have shown beneficial results for vegetation and overall diversity, except where fires have burned outside the prescriptions and high intensity and crown fires have occurred in ponderosa pine units. These types of fires have occurred in specific units comprised of ponderosa pine communities. Where crown fires and high intensity fires occur, management objectives have not been met.

Overall, prescribed fire would reintroduce natural succession processes for vegetative communities in the Shivwits Plateau area. Reintroduction of natural succession processes would allow the reinvansion of grasses and forbs, increasing vegetative ground cover and decreasing soil erosion, improving the overall health of the ecosystem.

Conclusion: There could be slight erosion after prescribed burns, until vegetative recovery occurs, creating minor impacts. Soils would generally benefit from prescribed burns through replacement of nutrients. In the pinyon-juniper, sagebrush and ponderosa pine communities, prescribed fires would allow natural successional processes to reestablish, resulting in new growth, the reintroduction of grasses and forbs, and increased vegetative biodiversity in the area. This would create long-term moderate to major beneficial impacts to the soils and vegetative communities.

Prescribed fires would reduce forest floor litter and prevent excessive buildup of hazardous fuels, which could prevent a large, catastrophic wildland fire from occurring, creating moderate to major beneficial impacts. Prescribed fire would result in ponderosa pine stand density restoring the ecosystem to a more natural condition promoting biodiversity and ecosystem health.

Fires that exceed prescription could result in scorching and crown fires in ponderosa pine communities. This could lead to detrimental impacts to these areas by damaging or killing presettlement trees and potentially altering the community structure. Mitigation measures would reduce the potential for this impact, however, the possibility for moderate impacts exists even with the mitigation measures.

Exotic species, such as cheat grass, could move into areas after burns and exotic plant control would be needed to prevent adverse impacts. Mitigation measures would reduce the potential for this impact, but there still is the potential for minor to moderate impacts from the establishment of exotic species. Fires could result in some soil erosion and runoff. In addition, trampling and ground disturbance from prescribed fire activities could adversely impact vegetation and soils, however impacts would be localized to high-traffic areas and would be considered minor impacts.

There would be no impairment to the soils and vegetative community from prescribed burns as areas would recover and impacts would be temporary in nature.

Impacts from Alternative B to Wildlife: Prescribed fires would burn portions of the sagebrush and pinyon-juniper communities, allowing the invasion of grasses and forbs, increases in biodiversity and understory growth, creating snags and forest mosaics, which would improve forage and wildlife habitat.

Some mechanized treatment would occur under this alternative. In units where mechanized treatment would occur, wildlife could be disturbed by the noise and presence of humans, and may be temporarily displaced. No cutting of dead snags, cavity trees, or nest trees would occur.

Early seral stage habitat is necessary for a healthy mule deer population. Prescribed fires would reintroduce the natural succession process for vegetative communities, resulting in various stages of succession and an improved mule deer habitat.

Animals which utilize dense ground vegetation and hazard fuels for food and cover may be reduced initially unless islands of vegetation remain intact or suitable habitat is available outside the burn areas. However, this impact would be temporary as grasses and forbs and other vegetation would return to the area following a fire.

Wildlife would be temporarily displaced during a prescribed fire and animals with specific habitat requirements or territorial animals with narrow ranges may be adversely impacted by habitat loss. Mortality from suffocation could occur to small vertebrates that would not be able to migrate away from fire areas. This impact would be localized to the boundaries of the prescribed fire, however it could temporarily result in a loss of prey for carnivores.

Prescribed fires could benefit soils by the return of nutrients and organic matter in the form of ash, and could lead to increased biodiversity by creating vegetative mosaics, which would improve wildlife habitat.

Habitat modification from prescribed fires could eventually lead to shifts to more natural conditions in species composition.

Some prescribed fires would occur during the spring nesting periods and could cause nest abandonment or outright mortality of nestlings. Since adult birds can migrate away from the fire, impacts to adults would be low, except for the loss in productivity.

Cumulative Impacts: Past burning activities has resulted in an increase in vegetative biodiversity and forest mosaics in most burn areas. This could contribute to overall improved wildlife habitat in the area and could lead to shifts to more natural conditions in species composition. Future habitat improvement would occur if similar results occur after the proposed prescribed fire program.

Conclusion: Adverse impacts to wildlife from prescribed fires would be localized, temporary and negligible to minor, while moderate to major beneficial impacts would be long-term and improve overall habitat conditions throughout the area.

Prescribed fires would burn portions of monoculture vegetative communities, contributing to an increase in biodiversity and creating forest mosaics, which would improve forage and wildlife habitat. Habitat modification from prescribed fires could eventually lead to shifts to more natural conditions in species composition. This could potentially create moderate to major beneficial impacts to the wildlife and wildlife habitat in the region.

Prescribed fires would temporarily displace some wildlife and mortality may occur to those animals that are unable to migrate away from the fire. The impacts would be localized to the actual fire area. Prescribed fires that occur during the spring nesting season may cause nest mortality or outright nest abandonment. There would be no impairment to wildlife species as a result of the impacts from this alternative.

Impacts from Alternative B to Sensitive, Threatened and Endangered Species: The threatened or endangered wildlife species that may utilize the Shivwits Plateau are birds and therefore generally mobile and able to move away from fire areas.

The threatened bald eagle is a rare winter visitor, does not nest in the region, and would not be adversely impacted by the implementation of a prescribed fire program. The peregrine falcon inhabits the cliff portions of the Shivwits Plateau. While this species is no longer listed as threatened or endangered, it is still considered a sensitive species in the recreation area. The peregrine falcon primarily uses cliff sites for nesting and rarely uses old tree nests or cavities, nest sites would not be adversely impacted by prescribed fires. If nesting sites are found in proposed prescribed fire areas, either during seasonal monitoring or during fire monitoring activities, fire lines would be constructed around nest sites and appropriate suppression activities would occur to prevent adverse impacts to the peregrine falcon.

Northern goshawk nests have been recorded in coniferous forest on BLM administered lands on the Arizona Strip, however if goshawk habitat was located in a burn area, it would be designated as a suppression zone and appropriate suppression measures would be taken to ensure that no adverse impacts would occur.

Potential habitat for the threatened Mexican spotted owl occurs on the Shivwits Plateau, though no occurrence has been recorded within or adjacent to the region. Potential Mexican spotted owl habitat, which includes spring areas, would not be located in the burn areas. If burns go beyond their prescription, potential habitat could be burned. Generally, this species would relocate

outside the burn area. If nests are found during monitoring activities, their location would be recorded and appropriate suppression activities would take place to protect the nests from adverse impacts. However, it is likely that this species would not be adversely impacted because it generally roosts within canyons, which are located in suppression or non-fire zones.

No threatened or endangered plants occur on the Shivwits Plateau, though two rare plants are known to exist in the region, the Grand Canyon rose (*Rosa stellata*) and *Penstemon distans*. Rare plant species habitat would not be in prescribed burns areas, therefore would be protected from the fire activities.

Mechanized pretreatment would occur only in the four specified juniper areas where the occurrence of threatened and endangered species is unlikely. No effect would occur from mechanized treatment in juniper woodlands.

Cumulative Impacts: No cumulative impacts would occur to threatened and endangered species.

Conclusion: Threatened and endangered species would not be impaired by the implementation of a prescribed fire program on the Shivwits Plateau. The threatened or endangered wildlife species that may utilize the Shivwits Plateau are birds and therefore generally mobile and able to move away from fire areas. There would be no impairment to threatened and endangered species.

Rare plant species would be protected from fire activities in the area and would not be impaired from the impacts of this alternative.

Impacts from Alternative B to Riparian Areas: Prescribed fires would not be ignited in riparian areas, however if a prescribed fire would exceed prescription levels and spread into a nearby riparian area, it could consume streamside vegetation or upslope cover, having temporary adverse impacts on riparian communities, including loss of cover, and increased erosion leading to decreased water quality. However, riparian areas are generally able to repel fires due to their cool, moist microclimate, and appropriate suppression actions would be taken to prevent riparian areas from burning. No adverse impacts would occur to riparian areas.

Cumulative Impacts: No cumulative impacts would occur to riparian areas.

Conclusion: If a prescribed fire exceeds prescription levels and spreads into a riparian area, minor to moderate impacts could occur if the burn creates a change in the riparian plant community and the water quality in that area. Since riparian areas would be designated as suppression zones and these areas are generally able to repel fires due to their cool, moist microclimate, riparian areas would not be impaired.

Impacts from Alternative B to Wilderness Areas: Prescribed fires could reduce hazard fuel buildup and prevent the need for drastic suppression measures in the case of a wildland fire. Suppression measures could include mechanical equipment, ground disturbance and construction of temporary structures that may harm the wilderness character and resources. Mitigation, as

described in the description of the alternatives section, and the use of light hand suppression techniques and appropriate minimum tools would reduce potential impacts to wilderness areas.

Since the evolutionary process of the ecosystem on the Shivwits Plateau included fire, the reintroduction of fire into the area would result in an eventual return to a more natural ecosystem.

The use of mechanized equipment in wilderness areas could temporarily impact the character of that area, creating short-term minor to moderate impacts. Prior to the use of any mechanized equipment, a minimum tool analysis would be conducted to assure the use of the appropriate tool. Also, work would be scheduled to reduce conflicts with visitors, and notification of the use of mechanized equipment would be provided to area residents and visitor centers to provide information on the project.

Cumulative Impacts: No cumulative impacts would occur to wilderness areas.

Conclusion: Short term minor to moderate impacts could occur to the wilderness due to the presence of mechanized equipment and the burn activities. This alternative could result in long-term moderate to major beneficial impacts to the wilderness through the return of more natural conditions on the Shivwits Plateau. Prescribed fires could protect wilderness areas from impairment by reducing hazard fuel buildup and possibly preventing a large, difficult to manage wildland fire from occurring.

Impacts from Alternative B to Grazing: Fire areas could be closed to grazing activities for 1 to 2 years following the fire to allow for habitat recovery. Temporary adverse impacts would occur to grazing activities as they would be suspended, however long-term impacts would be beneficial as the range would improve due to the creation of vegetation mosaics, the elimination of excess sagebrush and pinyon-juniper, and the growth of grasses and forbs after the fire.

Cumulative Impacts: A prescribed fire program would improve overall grazing conditions.

Conclusion: Temporary moderate to major adverse impacts would occur to grazing; however a prescribed fire program would have long-term beneficial impacts on grazing ranges as grasses and forbs would be allowed to reestablish in grazing areas. No impairment to grazing would occur from the impacts of this alternative.

Impacts from Alternative B to Air Quality: Prescribed fires could burn for more than several days, and smoke from these fires could have temporary adverse impacts to air quality in the immediate area of the burn, as well as in adjacent BLM and NPS administered lands. Fine organic and inorganic matter (particulate matter), such as ash, dust, and soil, less than 10 microns in diameter could be elevated locally on a temporary basis. Particulate matter less than 10 microns can collect in human lungs and be hazardous to health. These hazards would be minimal considering the remoteness of the Shivwits region. Personnel working on the fire would inhale these fumes. This is considered an inherent risk for firefighters.

Prevailing winds and other weather factors would determine whether smoke from a prescribed fire affects air quality elsewhere. Smoke could temporarily affect Grand Canyon NP air quality, a Class I airshed, and points further east.

The use of mechanized equipment could create temporary impacts from gasoline and diesel fumes. However these impacts would be localized at the treatment areas and would occur only during the limited use of this equipment.

Cumulative Impacts: No cumulative impacts would occur to air quality. Air quality cumulative impacts are regulated by ADEQ within the entire Grand Canyon Air shed including North Rim and South Rim. Burn days are staggered to reduce smoke impacts on the air shed. This air shed is strictly regulated by ADEQ, and burns are not approved if the air shed is already degraded.

Conclusion: A program of prescribed fire would temporarily impact air quality in the local area. Prevailing winds and other weather factors would determine the extent of these impacts. If several prescribed fires occur within the region concurrently, air quality of the Grand Canyon NP could be negatively impacted. Even though this impact is short-term and temporary, decreased visibility in the Grand Canyon is a major concern, and moderate to major impacts could be possible. Overall, air quality in the region would not be impaired by a prescribed fire program.

Impacts from Alternative B to Scenic Quality: Prescribed fires could burn for more than several days, and smoke from these fires could have temporary adverse effects on scenic quality in the area of the burn. Prevailing winds and other weather factors would determine whether smoke from a prescribed fire impacts scenic quality elsewhere. Smoke could temporarily impact Grand Canyon NP scenic quality, and points further east.

Dense, even-aged stands of vegetation, including grasses, sagebrush, pinyon-juniper, and ponderosa pine would be burned, opening up the viewshed and creating uneven-aged stands which provide a more natural appearance. This could create minor to moderate long-term beneficial impacts to the area. Cut and burned vegetation could adversely impact the scenic quality but this impact would be localized to specific burn areas.

Cumulative Impacts: Prescribed fires could burn dense, unnatural looking, even-aged stands of vegetation, improving the view shed and resulting in a more natural scenic setting throughout the Shivwits Plateau. Past activities and similar programs in adjacent lands administered by the BLM have improved the scenic value of the ecosystem. Future activities would further improve the scenic quality of the area.

Conclusion: Scenic quality would be temporarily impacted by smoke during prescribed fires and prevailing winds and other weather conditions would determine the extent of this impact. Dense, even-aged stands of vegetation would be burned, opening up the viewshed and creating a more natural skyline. Although burn areas might at first detract from the visitor experience, eventually there could be minor to moderate beneficial impacts to the view shed due to more open areas and natural skylines created by prescribed fires. Overall scenic quality would not be impaired as a result of the impacts from this alternative.

Impacts from Alternative B to Cultural Resources: Fire suppression zones would be designated around cultural resources that could be damaged or destroyed by fire, i.e. wood structures, petroglyph sites, etc.. Appropriate suppression activities would occur within this zone to prevent damage to these resources, therefore, they would not be adversely affected by a prescribed fire program. On archeological sites the amount of damage to surface and subsurface resources depends on fire intensity. Minimal or no damage would occur to commonly found surface artifacts, such as flaked stone, ground stone, and ceramics, from low-intensity fires. High intensity fires could cause damage to surface and subsurface resources by shattering flaked stone and ground stone artifacts, warping ceramics and burning paint, and burning organic materials such as bone, seeds, and pollen.

A secondary impact from soil erosion or trampling and ground disturbance during or after a fire would be exposure of previously covered cultural resources. Increased visibility after a fire could lead to increased vandalism to sites.

Cumulative Impacts: No cumulative impacts would occur to cultural resources.

Conclusion: Cultural resources that could be damaged or destroyed by fire would be contained within fire suppression zones, therefore, they would not be impacted by prescribed fires. Archeological resources should not be impacted by low intensity fires, however, high-intensity fires could damage these resources. Secondary impacts may include exposure of previously covered cultural resources as a result of soil erosion or trampling and ground disturbance during prescribed fire activities. All areas would be systematically surveyed by an archeologists prior to any prescribed fire activities. The surveys would identify where suppression zones are needed and where heavy fuels would need to be removed from sites to protect cultural resources. These measures would prevent damage to cultural resources from prescribed fires. There would be no impairment to cultural resources under this alternative.

Impacts from Alternative B to Visitor Use: During a prescribed fire, the fire perimeter would be closed to visitor access. Visitor use would only be temporarily impacted and visitors would be directed to alternative use areas. Visitors who expect a quiet experience may be impacted by the noise from mechanical equipment, such as chainsaws.

Cumulative Impacts: No cumulative impacts would occur to visitor use.

Conclusion: Visitors use patterns would be temporarily impacted and impacts would be localized to the prescribed fire area, therefore, the impacts would be considered minor. Visitor use in the area would not be impaired as a result of the impacts from this alternative.

Impacts from Alternative B to Safety: Prescribed fires that escape containment could threaten the safety of fire crews. In severe cases where containment is unachievable, the safety of adjacent communities could also be threatened. However, prescribed fires would only be ignited under optimum conditions where an escape is highly unlikely, reducing the possibility of impacts to fire crew and visitor safety. In addition, administrative structures, residential areas and recreational

sites would be designated as suppression zones, and suppression measures would be prepared prior to ignition of the prescribed fire.

Prescribed fires could reduce the accumulation of hazardous fuels, increasing prevention of a large, difficult to manage wildland fire and reducing the resulting safety threat from such a fire.

The use of mechanical methods, including chainsaws, prior to burning could lead to unsafe conditions. However, all staff would be trained in the use of mechanical equipment, and proper safety gear would be used, thereby reducing the overall risk.

Cumulative Impacts: No cumulative impacts would occur to safety.

Conclusion: Prescribed fires could escape containment, adversely impacting the safety of fire crews and adjacent communities. However, to prevent threatening the safety of fire crews, visitors, and adjacent communities, prescribed fires would only be ignited under optimum conditions that would prevent escape of the fire. Prescribed fires could reduce the buildup of hazardous fuels, decreasing the possibility of a large, difficult to manage wildland fire. Impacts to the safety of fire crews and adjacent communities would be minor. No impairment would occur as a result of the impacts associated with this alternative.

Impacts from Alternative B to Recreation Area Operations: If a prescribed fire plan is approved, the recreation area would need to have adequate staff, equipment, and training to safely and legally carry out the functions of the program. This could require an increase in current staff levels.

Prescribed fires that escape containment could require the recreation area to dispatch additional fire crews and equipment to the site and assistance may be required from other agencies or parks.

Cumulative Impacts: There would be no cumulative impacts.

Conclusion: An increase in staff, equipment, and training may be required to accomplish a prescribed fire program. In the case of an escaped prescribed fire, additional staff and equipment and assistance from other agencies may be necessary. Recreation area operations would not be impaired as a result of this alternative.

Alternative C – Combination of Prescribed Fire and Restoration Thinning

Impacts from Alternative C to Soils and Vegetation: Mechanical treatment may be used to remove some of the postsettlement trees in each treatment unit. The amount would depend on the evaluation of each treatment area. Between 30 and 70 percent of the trees could be removed depending on the evaluation. Prescribed fires would reintroduce a necessary major cause of disturbance in the sagebrush scrub, ponderosa pine, and pinyon-juniper woodlands of the Shivwits Plateau. After burning there would be a loss of trees to meet management objectives, and a reduction of dead and down woody material on the forest floor.

The thinning process would allow successful new growth and the reestablishment of grasses and forbs, improving the overall health of the pinyon-juniper and sagebrush communities. The treatment program would reduce vegetative monocultures and improve biodiversity in sagebrush communities by thinning out overgrown sagebrush and allowing understory growth, which decreases soil erosion and improves overall health of the vegetative ecosystem. The treatment program would result in a mosaic of uneven aged stands of ponderosa pine, oak, and juniper.

Restoration thinning in ponderosa pine communities could reduce the decline in vigor of presettlement ponderosa pine. This method has resulted in increased canopy growth, and the uptake of water, nitrogen, and carbon, in other areas, including in Mt. Trumbull area. It has improved the overall health of the ponderosa pine community.

It is hoped that under this alternative that within the treatment zones, a natural fire cycle would reestablish. Periodic stand-replacing or type-converting fires would be prescribed, allowing shrub and pinyon-juniper woodland communities to return to early successional stages. Vegetation, including grasses, sagebrush, and pinyon-juniper would burn, allowing new growth, creating uneven-aged stands, which could lead to a more healthy vegetation community. Grasses and forbs would dominate sites after a burn. In optimum situations, grasses and forbs would be followed by the re-establishment of shrubs followed by pinyon-juniper woodlands. The successional process would take decades and the progression of seral stages and the occurrence of prescribed fires would provide a mosaic of vegetation and more accurately reflect natural processes, improving the overall health of the vegetative ecosystem. This has the potential to create moderate to major long-term beneficial impacts to the vegetative communities.

Prescribed fires would reduce forest floor litter and prevent excessive buildup of hazardous fuels, which could prevent a large, difficult to manage wildland fire from occurring. There is the potential that prescribed fires could burn out of prescription within the ponderosa pine areas, resulting in crown scorching and cambial damage to the trees. Cambial damage is most likely to occur when high intensity fires are maintained at the base of a tree. Trees only partially damaged have a better chance of survival. High intensity fires also lead to crown scorching, which is the principle cause of pine mortality after a fire. Mitigation measures, such as raking around old growth trees, removal of slash, and mechanical pretreatment, create a less intense fire and minimize these risks. The impact would be considered moderate.

Exotic species, such as cheat grass, could move into areas after burns, potentially outcompeting native grasses and forbs. Exotic plant control mitigation measures would be used to prevent adverse impacts to native species. Even with the mitigation measures, some exotic species could occur in the treatment area during the recovery period, and potentially for a duration of several years or longer. Therefore, the impact from exotics species could be moderate to major in the treatment areas if not controlled through the mitigation measures.

Fires can benefit soils by the return of nutrients and organic matter in the form of ash. Prescribed fire in ponderosa pine stands can release substantial amounts of nutrients from the surface organic materials. Fire accelerates nutrient cycling mainly by mineralizing nutrients, and postburn

increases in available soil inorganic nitrogen has been reported. This would create minor to moderate beneficial impacts to the soils.

Fires could result in some soil erosion and run-off, depending on amount of vegetation burned, soil, slope, and fire frequency. However, these impacts would be short-term and minor to moderate, as grasses and forbs would reestablish in the area and provide ground cover, decreasing erosion.

Trampling and ground disturbance from prescribed fire and restoration thinning activities could adversely impact vegetation and soils, however impacts would be localized to high-traffic areas. The use of a tree shearer and portable sawmill could impact soils by creating tracks and ruts. These would be negligible to minor impacts.

Cumulative Impacts: Past burning activities have shown beneficial results for vegetation and overall diversity, except where fires have burned outside the prescriptions and high intensity and crown fires have occurred in ponderosa pine communities. Since ponderosa pine communities could be thinned using mechanical means and fire, fires burning outside management prescriptions would be unlikely under this alternative. However, the potential for high intensity wildland fires exists, but would be reduced under this alternative.

Overall, prescribed fire would reintroduce natural succession processes for certain vegetative communities in the Shivwits Plateau area. Reintroduction of natural succession processes would allow the reinvasion of grasses and forbs, increasing vegetative ground cover and decreasing soil erosion, improving the overall health of the ecosystem.

Conclusion: There could be negligible to minor impacts from the slight erosion after prescribed burns, until vegetative recovery occurs. Soils would generally benefit from prescribed burns through replacement of nutrients, creating minor to moderate beneficial impacts. In the pinyon-juniper, and sagebrush communities, prescribed fires would allow natural successional processes to reestablish, resulting in new growth, the reintroduction of grasses and forbs, and increased vegetative biodiversity in the area. This would create moderate to major beneficial impacts.

Restoration thinning and burn treatments would reduce forest floor litter and prevent excessive buildup of hazardous fuels in ponderosa pine communities, which could prevent a large, difficult to manage wildland fires from occurring. As a result of restoration thinning, ponderosa pine trees could increase in vigor with the increase in canopy growth, and the increased uptake of water, nitrogen, and carbon, creating minor to moderate beneficial impacts to the ponderosa pine community.

Exotic species, such as cheat grass, could move into areas after burns and exotic plant control would be needed to prevent adverse impacts. Minor to moderate adverse impacts could still occur from the establishment of exotic plants in treatment areas. Fires could result in some soil erosion and runoff, creating negligible to minor impacts. Trampling and ground disturbance from prescribed fire activities could create negligible to minor adverse impacts to the vegetation and soils; however, the impacts would be localized to high-traffic areas.

Implementing this alternative has the potential to create moderate to major beneficial impacts to the vegetation and soils, in the long-term, by restoring the natural processes. There would be no impairment to the soils and vegetative community from prescribed burns as areas would recover and impacts would be temporary in nature.

Impacts from Alternative C to Wildlife: Restoration thinning would open up stands of ponderosa pine, allowing more nutrient uptake and improving the vigor of the trees. This could lead to improved habitat for wildlife that relies on old growth forests. This would improve the quality of the wildlife habitat and could result in long-term moderate to major beneficial impacts to wildlife and wildlife habitat.

Prescribed fires would burn portions of the sagebrush and pinyon-juniper communities, allowing the invasion of grasses and forbs, increases in biodiversity and understory growth, creating snags and forest mosaics, which would improve forage and wildlife habitat and create moderate to major beneficial impacts.

Early seral stage habitat is necessary for a healthy mule deer population. Prescribed fires would reintroduce the natural succession process for vegetative communities, resulting in moderate beneficial impacts due to the change in plant community to various stages of succession and an improved mule deer habitat.

Animals which utilize dense ground vegetation and hazard fuels for food and cover may be reduced, however islands of dense vegetation would remain intact and suitable habitat is available outside the treatment areas. This impact would be temporary and minor as grasses and forbs and other vegetation would return to the area following the treatment.

Wildlife would be temporarily displaced during treatment activities and animals with specific habitat requirements or territorial animals with narrow ranges may be adversely impacted by habitat loss. Mortality from suffocation could occur to small vertebrates that would not be able to migrate away from fire areas. This impact would be localized to the boundaries of the prescribed fire, however it could temporarily result in a loss of prey for carnivores, creating minor to adverse impacts.

Prescribed fires could benefit soils by the return of nutrients and organic matter in the form of ash, and could lead to increased biodiversity by creating vegetative mosaics, which would create moderate beneficial impacts by improving the wildlife habitat.

Habitat modification from the treatment activities could eventually lead to shifts to more natural conditions in species composition.

Some prescribed fires would occur during the spring nesting periods and could cause nest abandonment or outright mortality of nestlings. Mitigation measures should reduce these impacts from moderate to minor. Since adult birds can migrate away from the fire, impacts to adults would be low, except for the loss in productivity.

Cumulative Impacts: Past burning activities has resulted in an increase in vegetative biodiversity and forest mosaics in most burn areas. This could contribute to overall improved wildlife habitat in the area and could lead to shifts to more natural conditions in species composition. Future habitat improvement would occur if similar results occur after the proposed prescribed fire program.

Conclusion: Adverse impacts to wildlife from prescribed fires would be localized, temporary and negligible to minor, while moderate to major beneficial impacts would occur as a result of the long-term improvements to the overall habitat conditions throughout the area.

Prescribed fires and restoration thinning would change portions of monoculture vegetative communities into more diverse, open areas with forest mosaics, which would improve forage and wildlife habitat. Habitat modification from treatment activities could eventually lead to shifts to more natural conditions in species composition.

Prescribed fires would temporarily displace some wildlife and mortality may occur to those animals that are unable to migrate away from the fire. The impacts would be localized to the actual fire area. Prescribed fires that occur during the spring nesting season may cause nest mortality or outright nest abandonment. There would be no impairment to wildlife species as a result of the impacts from this alternative.

Impacts from Alternative C to Sensitive, Threatened, and Endangered Species: The threatened or endangered wildlife species that may utilize the Shivwits Plateau are birds and therefore generally mobile and able to move away from treatment areas.

The threatened bald eagle is a rare winter visitor, does not nest in the region, and would not be adversely impacted by the implementation of a prescribed fire program. The peregrine falcon inhabits the cliff portions of the Shivwits Plateau. While this species is no longer listed as threatened or endangered, it is still considered a sensitive species in the recreation area. The peregrine falcon primarily uses cliff sites for nesting and rarely uses old tree nests or cavities, nest sites would not be adversely impacted by prescribed fires. If nesting sites are found in proposed treatment areas, either during seasonal monitoring or during fire monitoring activities, those sites would be protected, fire lines would be constructed around nest sites and appropriate suppression activities would occur to prevent adverse impacts to the peregrine falcon.

Northern goshawk nests have been recorded in coniferous forest on BLM administered lands on the Arizona Strip, however if goshawk habitat was located in a treatment area, it would be designated as a suppression zone or non-treatment zone, and appropriate measures would be taken to ensure that no adverse impacts would occur.

Potential habitat for the threatened Mexican spotted owl occurs on the Shivwits Plateau, though no occurrence has been recorded within or adjacent to the region. Treatment areas are not located in potential Mexican spotted owl nesting habitat, which includes spring and canyon areas. There is the potential for the species to utilize the ponderosa pine communities, designated by the USFWS as "other forests and woodland types" for foraging, wintering, migration, and when

dispersing as juveniles. Generally, this species could relocate outside the area during treatment activities.

In the highly unlikely scenario that nests are found in ponderosa pine treatment areas during monitoring and pretreatment activities, their location would be recorded, no treatment would occur around the nest site, and appropriate suppression activities would take place during prescribed burns to protect the nests from adverse impacts.

Restoration treatments under this alternative would modify the existing potential Mexican spotted owl habitat, resulting in uneven aged stands of ponderosa pine and a mosaic type habitat which would lead to the reestablishment of understory herbaceous species. Snags and cavity trees would be protected. This could result in improved habitat, in the long-term, creating moderate beneficial impacts. It would protect the habitat from catastrophic wildfires by removing postsettlement trees, slash debris, and protecting the old growth trees. This alternative would reduce the risk of crown fires with mechanical pretreatment.

This species would not likely be adversely impacted because nest are generally found within canyons, which are located in non-treatment zones. Any nests that are found within the treatment areas would be protected from removal and burning.

No threatened or endangered plants occur on the Shivwits Plateau, though two rare plants are known to exist in the region, the Grand Canyon rose (*Rosa stellata*) and *Penstemon distans*. Rare plant species habitat would not be in prescribed burns areas, therefore would be protected from the fire activities.

Cumulative Impacts: No cumulative impacts would occur to threatened and endangered species.

Conclusion: Threatened and endangered species would not be impaired by the implementation of a prescribed fire and restoration thinning program on the Shivwits Plateau. The threatened or endangered wildlife species that may utilize the Shivwits Plateau are birds and therefore generally mobile and able to move away from fire areas. There would be no impairment to threatened and endangered species.

Rare plant species would be protected from fire activities in the area and would not be impaired.

Impacts from Alternative C to Riparian Areas: Prescribed fires and restoration thinning would not occur in riparian areas. However, if a prescribed fire would exceed prescription levels and spread into a nearby riparian area, it could consume streamside vegetation or upslope cover, having temporary minor to moderate adverse impacts on riparian communities, including loss of cover, and increased erosion leading to decreased water quality. However, riparian areas are generally able to repel fires due to their cool, moist microclimate, and appropriate suppression actions would be taken to prevent riparian areas from burning. Negligible to minor adverse impacts would occur to riparian areas.

Cumulative Impacts: No cumulative impacts would occur to riparian areas.

Conclusion: Negligible to minor impacts could occur to riparian areas if a prescribed fire exceeds prescription levels and spreads into a riparian area. Since riparian areas would be designated as suppression zones and these areas are generally able to repel fires due to their cool, moist microclimate, riparian areas would not be impaired.

Impacts from Alternative C to Wilderness Areas: Prescribed fire and restoration thinning could reduce hazard fuel buildup and prevent the need for drastic suppression measures in the case of a wildland fire. Suppression measures could include mechanical equipment, ground disturbance and construction of temporary structures that may harm the wilderness character and resources. Mitigation, as described in the description of the alternatives section, and the use of appropriate suppression techniques through the minimum tool analysis, would reduce potential impacts to wilderness areas. The minimum tool in most areas would be the use of chainsaws, and in other areas, could be the use of chainsaws and a tree shearer. In areas nearby existing roads a portable sawmill could be used to reduce hazard fuels from restoration activities. A tree shearer is used with a bobcat, and the sawmill is pulled behind a vehicle. This would temporarily detract from the wilderness character of the area through noise and the visual impact of cut trees and the presence of mechanized equipment, creating minor to moderate impacts to the wilderness area.

Since the evolutionary process of the ecosystem on the Shivwits Plateau included fire, the reintroduction of fire into the area would result in an eventual return to a more natural ecosystem, which is a moderate beneficial impact. The pretreatment of management units would prevent a large, difficult to control fire, which could result in more intrusive suppression techniques.

Cumulative Impacts: No cumulative impacts would occur to wilderness areas.

Conclusion: Restoration thinning with mechanical equipment could temporarily detract from the wilderness character of the area. Prescribed fires could protect wilderness areas from impairment by reducing hazard fuel buildup and possibly preventing a large, difficult to manage wildland fire from occurring. Overall the beneficial impact to wilderness areas from this alternative would be moderate to major since there is the potential to restore the area and allow natural processes to occur. No impairment to the wilderness resource or character would occur as a result of the impacts from this alternative.

Impacts from Alternative C to Grazing: Treatment areas could be closed to grazing activities for 1 to 2 years following the fire to allow for habitat recovery. Temporary minor to moderate adverse impacts would occur to grazing activities as they would be suspended, however long-term impacts would be beneficial as the range would improve due to the creation of vegetation mosaics, the elimination of excess sagebrush and pinyon-juniper, and the growth of grasses and forbs after the fire.

Cumulative Impacts: A prescribed fire program would improve overall grazing conditions.

Conclusion: Temporary minor to moderate adverse impacts would occur to grazing, however a prescribed fire program would have long-term moderate beneficial impacts on grazing ranges as grasses and forbs would be allowed to reestablish in grazing areas. No impairment to grazing would occur as a result of the impacts from this alternative alternative.

Impacts from Alternative C to Air Quality: Prescribed fires could burn for more than several days, and smoke from these fires could have temporary adverse impacts to air quality in the immediate area of the burn, as well as in adjacent BLM and NPS administered lands. Fine organic and inorganic matter (particulate matter), such as ash, dust, and soil, less than 10 microns in diameter could be elevated locally on a temporary basis. Particulate matter less than 10 microns can collect in human lungs and be hazardous to health. These hazards would be minimal to the general public considering the remoteness of the Shivwits region. Fire crews would be temporarily impacted from inhaling smoke and particulate matter. Prevailing winds and other weather factors would help prescribed fire specialists to determine whether smoke from a prescribed fire affects air quality elsewhere. Mitigation measures would be implemented to reduce the potential impact to minor. Smoke could temporarily affect Grand Canyon NP air quality, a Class I airshed, and points further east, creating moderate to major negative impacts to the air quality in certain circumstances. Mitigation measures could reduce this impact to minor to moderate.

Restoration thinning should have negligible impacts to the air quality. The fumes from the use of mechanical equipment, such as chain saws, could create temporary, localized impacts to the project area air quality. Saw dust would be produced if a portable sawmill was used. This would temporarily create minor to moderate impacts from dust in the localized area where it is being used.

Cumulative Impacts: No cumulative impacts would occur to air quality. Air quality cumulative impacts are regulated by ADEQ within the entire Grand Canyon Air shed including North Rim and South Rim. Burn days are staggered to reduce smoke impacts on the air shed. This air shed is strictly regulated by ADEQ, and burns are not approved if the air shed is already degraded.

Conclusion: A program of prescribed fire would temporarily impact air quality in the local area. Prevailing winds and other weather factors would determine the extent of these impacts. If several prescribed fires occur within the region concurrently, air quality of the Grand Canyon NP would be negatively impacted. Even though this impact is short-term and temporary, decreased visibility in the Grand Canyon is a major concern and prescribed burns could create minor to major impacts. Overall, air quality in the region would not be impaired by the impacts from the prescribed fire and restoration thinning program.

Impacts from Alternative C to Scenic Quality: Prescribed fires could burn for more than several days, and smoke from these fires could have temporary adverse effects on scenic quality in the area of the burn. Prevailing winds and other weather factors would determine whether smoke from a prescribed fire impacts scenic quality elsewhere. Smoke could temporarily impact Grand Canyon NP scenic quality, and points further east.

Dense, even-aged stands of vegetation, including grasses, sagebrush, and pinyon-juniper would be burned, opening up the viewshed and creating uneven-aged stands which provide a more natural appearance. Burned vegetation could adversely impact the scenic quality but this impact would be localized to specific burn areas.

Stands of ponderosa pine and juniper would be opened up through the restoration thinning process. The scenic quality would be temporarily impacted during the initial phase of this work as trees are cut, however, in the long-term, the overall scenic quality of these forests should improve, creating moderate beneficial impacts.

Cumulative Impacts: Prescribed fires could burn dense, unnatural looking, even-aged stands of vegetation, improving the view shed and resulting in a more natural scenic setting throughout the Shivwits Plateau. Restoration thinning has been shown, on adjacent BLM administered lands, to improve the overall scenic quality of the ponderosa pine forests. Past activities and similar programs in adjacent lands administered by the BLM have improved the scenic value of the ecosystem. Future activities would further improve the scenic quality of the area.

Conclusion: Scenic quality would be temporarily impacted by smoke during prescribed fires and prevailing winds and other weather conditions would determine the extent of this impact. It is likely to be a minor to moderate impact. Dense, even-aged stands of vegetation would be burned, opening up the viewshed and creating a more natural skyline. Although burn areas might at first detract from the visitor experience, eventually the view shed could improve due to more open areas and natural skylines created by prescribed fires. Overall scenic quality would not be impaired as a result of the impacts associated with this alternative.

Impacts from Alternative C to Cultural Resources: Impacts from this alternative are the same as the impacts from Alternative B. Fire suppression zones would be designated around cultural resources that could be damaged or destroyed by fire, i.e. wood structures, petroglyph sites, etc.. Appropriate suppression activities would occur within this zone to prevent damage to these resources. Therefore, they would not be adversely affected by a restoration thinning and prescribed fire program. On archeological sites the amount of damage to surface and subsurface resources depends on fire intensity. Minimal or no damage would occur to commonly found surface artifacts, such as flaked stone, ground stone, and ceramics, from low-intensity fires. High intensity fires could cause damage to surface and subsurface resources by shattering flaked stone and ground stone artifacts, warping ceramics and burning paint, and burning organic materials such as bone, seeds, and pollen.

A secondary impact from soil erosion or trampling and ground disturbance during treatment or after a fire would be exposure of previously covered cultural resources. Increased visibility after a fire or treatment activity could lead to increased vandalism to sites.

Cumulative Impacts: No cumulative impacts would occur to cultural resources.

Conclusion: Cultural resources that could be damaged or destroyed by fire would be contained within fire suppression zones. Therefore, they would not be impacted by prescribed fires.

Archeological resources should not be impacted by low intensity fires, however, high-intensity fires could damage these resources. Secondary impacts may include exposure of previously covered cultural resources as a result of soil erosion or trampling and ground disturbance during prescribed fire activities. All areas would be systematically surveyed by an archeologists prior to any mechanical treatment and prescribed fire activities. The surveys would identify where mechanical thinning should be avoided and where suppression zones are needed to protect cultural resources. They would also identify where thinning and heavy fuel reduction is needed to protect cultural resources. These measures would prevent damage to cultural resources by mechanical thinning and prescribed fires. There would be no impairment to cultural resources from the impacts of this alternative.

Impacts from Alternative C to Visitor Use: During a prescribed fire or restoration thinning, the perimeter of the treatment area would be closed to visitor access. Visitor use would only be temporarily impacted and visitors would be directed to alternative use areas. Visitors may be disturbed by the noise of mechanical equipment, such as chainsaws and other associated tools. These impacts would be negligible to minor, since they would be temporary and localized to within one to two miles of the project area.

Cumulative Impacts: No cumulative impacts would occur to visitor use.

Conclusion: Visitors use patterns would be temporarily impacted and impacts would be negligible to minor due to the localized nature of the prescribed fire and restoration thinning treatment areas. Visitor use in the area would not be impaired as a result of the impacts from this alternative.

Impacts from Alternative C to Safety: Prescribed fires that escape containment could threaten the safety of fire crews. In severe cases where containment is unachievable, the safety of adjacent communities could also be threatened. However, prescribed fires would only be ignited under optimum conditions where an escape is highly unlikely, reducing the possibility of impacts to fire crew and visitor safety. In addition, administrative structures, residential areas and recreational sites would be designated as suppression zones, and suppression measures would be prepared prior to ignition of the prescribed fire.

Prescribed fires and restoration thinning could reduce the accumulation of hazardous fuels, increasing prevention of a large, difficult to manage wildland fire and reducing the resulting safety threat from such a fire.

The use of chain saws and other power equipment could create unsafe conditions. However, crews would be trained and protective gear would be worn, and while there is always a risk when using this type of equipment, this would reduce the potential for injury.

Cumulative Impacts: No cumulative impacts would occur to safety.

Conclusion: Prescribed fires could escape containment, adversely impacting the safety of fire crews and adjacent communities. However, to prevent threatening the safety of fire crews,

visitors, and adjacent communities, prescribed fires would only be ignited under optimum conditions that would prevent escape of the fire. Therefore, this impact is expected to be minor. Prescribed fires and restoration thinning would reduce the buildup of hazardous fuels, decreasing the possibility of a large, difficult to manage wildland fire. No impairment would occur as a result of the impacts from this alternative.

Impacts from Alternative C to Recreation Area Operations: If a prescribed fire and restoration thinning program is approved, the recreation area would need to have adequate staff, equipment, and training to safely and legally carry out the functions of the program. This could require an increase in current staff levels.

Prescribed fires that escape containment could require the recreation area to dispatch additional fire crews and equipment to the site and assistance may be required from other agencies or parks.

Cumulative Impacts: There would be no cumulative impacts.

Conclusion: An increase in staff, equipment, and training may be required to accomplish a prescribed fire and restoration thinning program. In the case of an escaped prescribed fire, additional staff and equipment and assistance from other agencies may be necessary. Recreation area operations would not be impaired due to the impacts of this alternative.

Alternative D – Chemical Treatment of Vegetation 5-year Plan

Impact from Alternative D to Soil and Vegetation: Chemical treatment and removal of vegetation would provide a necessary major cause of disturbance in the sagebrush scrub and pinyon-juniper woodlands of the Shivwits Plateau. The thinning process that would result would allow successful new growth and the reestablishment of grasses and forbs, improving the overall health of the pinyon-juniper and sagebrush communities. In addition, chemical treatment and removal of vegetation would reduce monocultures and improve biodiversity in sagebrush communities by thinning out overgrown sagebrush and allowing understory growth, creating a vegetative mosaic that would decrease soil erosion.

In chemically treated zones a natural successional cycle would reestablish. Removal of even-aged stands would allow shrub and pinyon-juniper woodland communities to return to early successional stages. Vegetation, including grasses, sagebrush, pinyon-juniper, and ponderosa pine would be thinned, allowing for new growth, creating uneven-aged stands, leading to a more healthy vegetation community. Grasses and forbs would dominate sites after vegetation treatments. In optimum situations, grasses and forbs would be followed by the re-establishment of shrubs followed by pinyon-juniper woodlands. The successional process would take decades and the progression of seral stages and the occurrence of vegetation treatments to thin overly dense vegetation would provide a mosaic of vegetation and more accurately reflect natural processes, improving the overall health of the vegetative ecosystem.

Since herbicide completely eradicates plants, underground root systems that depend on the vascular tissue of above-ground plants could be adversely impacted. These impacts would be localized to treatment areas and would be considered minor impacts.

Chemical treatment and removal of vegetation, which could be physical removal or burning, would reduce forest floor litter and prevent excessive buildup of hazardous fuels, which could prevent a large, difficult to manage wildland fire from occurring. Exotic species, such as cheat grass, could move into areas after burns, potentially outcompeting native grasses and forbs. Exotic plant control measures would be implemented to prevent adverse impacts to native species. Even with mitigation and control measures, exotic species could move into a treatment area. However, this could be a temporary stage and over time, native plants could recover. Therefore, impacts would be expected to be minor to moderate.

Chemical treatment and removal of vegetation could result in some soil erosion and run-off, depending on amount of vegetation treated, soil, slope, and fire frequency. However, these impacts would be minor, as they would be short-term as grasses and forbs would reestablish in the area and provide ground cover, decreasing erosion.

Trampling and ground disturbance from chemical treatment activities could adversely impact vegetation and soils, however impacts would be minor and localized to high-traffic areas.

Chemical treatment of vegetation could adversely impact non-target plants through soil contamination or drift over from spraying of target plants. In the case of spray treatments applied from the ground, these impacts would be localized to the spray area and the plants immediately surrounding the area, and would be minor impacts. Aerial spray treatments could have more widespread impacts as spray could drift further from the target areas. Granular treatments (dry pellets applied to the soil) may contaminate the soil and have the potential to spread beyond the immediate area of treatment through soil runoff, by eradicating roots of other vegetation, or by contaminating non-target seeds. Adverse impacts would be minor to moderate, as they would be temporary as the herbicides used would have a low level of persistence in the environment, preventing permanent soil contamination and impairment of vegetation communities.

Cumulative Impacts: Chemical treatment and removal of vegetation would reintroduce natural succession processes for vegetative communities in the Shivwits Plateau area. Reintroduction of natural succession processes would allow the reinvasion of grasses and forbs, increasing vegetative ground cover and decreasing soil erosion, improving the overall health of the ecosystem.

Conclusion: Chemical treatment of vegetation would allow natural succession processes to reestablish, resulting in new growth, the reintroduction of grasses and forbs, and increased vegetative biodiversity in the area. Treatment and removal of vegetation would reduce forest floor litter and prevent excessive buildup of hazardous fuels, which could prevent a large, difficult to manage wildland fire from occurring.

Exotic species, such as cheat grass, could move into areas after treatment and removal of vegetation could result in some soil erosion and runoff. In addition, trampling and ground disturbance from treatment activities could adversely impact vegetation and soils, however impacts would be localized to high-traffic areas.

Chemical treatment of vegetation could adversely impact non-target plants through soil contamination or drift over from spray treatments. However, the overall health of vegetation on the Shivwits Plateau would improve, and moderate beneficial impacts would occur. There would not be impairment as adverse impacts would be temporary and localized to treatment areas due to the herbicide's low level of persistence in the environment.

Impacts from Alternative D to Wildlife: Chemical treatment would thin portions of the sagebrush and pinyon-juniper communities, allowing the invasion of grasses and forbs, increases in biodiversity and understory growth, creating snags and forest mosaics, which would improve forage and wildlife habitat.

Animals which utilize dense ground vegetation and hazard fuels for food and cover may be reduced initially unless islands of vegetation remain intact or suitable habitat is available outside the treatment areas. However, this impact would be temporary and minor as habitat would be available outside the treatment area, and grasses, forbs, and other vegetation would return to the area following treatment.

Wildlife would be temporarily displaced by noise and human presence during chemical treatments and animals with specific habitat requirements or territorial animals with narrow ranges may be adversely impacted by habitat loss. If chemically treated vegetation is burned following the treatment, wildlife would be temporarily displaced during the burn and mortality from suffocation could occur to small vertebrates that would not be able to migrate away from burn areas. This minor to moderate impact would be localized to the debris burn area.

Although directly treated vegetation would either be burned or removed from the area, non-target plants that have herbicide residue from drift-over or soil contamination may be left in treatment areas. If these plants are ingested immediately following treatment, smaller mammal populations could be temporarily reduced, which may result in a temporary loss of prey for carnivores. However, since wildlife is usually displaced temporarily during human presence, and since herbicides with a low level of persistence in the environment would be used, there would be low occurrences of wildlife presence in treatment areas during the period in which the herbicides would have moderate adverse impacts on wildlife.

Early seral stage habitat is necessary for a healthy mule deer population. Chemical treatment of vegetation would reintroduce the natural succession process for vegetative communities, resulting in various stages of succession and an improved mule deer habitat.

Habitat modification from chemical vegetation treatments could eventually lead to shifts to more natural conditions in species composition, creating moderate to major long-term beneficial impacts.

Since some chemical treatments would occur during the spring nesting periods, noise and human presence during these activities could cause nest abandonment or outright mortality of nestlings. Since adult birds can migrate away from treatment areas, impacts to adults would be negligible except for the loss in productivity.

Cumulative Impacts: The increase in vegetative biodiversity and forest mosaics from chemical treatments would contribute to overall improved wildlife habitat in the area and could lead to shifts to more natural conditions in species composition.

Conclusion: Adverse impacts to wildlife from chemical vegetation treatments would be localized, temporary and negligible to minor, while beneficial impacts would be long-term and moderate to major, serving to improve the overall habitat conditions throughout the area.

Chemical treatment of vegetation would thin portions of monoculture vegetative communities, contributing to an increase in biodiversity and creating forest mosaics, which would improve forage and wildlife habitat. Habitat modification from chemical vegetation treatments could eventually lead to shifts to more natural conditions in species composition, producing moderate to major beneficial impacts.

Noise and foot traffic from chemical treatment activities that occur during the spring nesting season may cause nest mortality or outright nest abandonment. Though this would be a temporary impact localized in the treatment area. No impairment would occur as a result of the impacts of this alternative.

Impacts from Alternative D to Threatened and Endangered Species: The threatened or endangered wildlife species that may utilize the Shivwits Plateau are birds and therefore generally mobile and able to move away from chemical treatment areas.

The threatened bald eagle is a rare winter visitor, does not nest in the region. The sensitive peregrine falcon may be found throughout the area, and may inhabit the area year-round. Since the falcon generally nests on ledges on cliff sites and rarely uses old tree nests or cavities, nest sites would not be adversely impacted by chemical treatments. If nesting sites are found in proposed treatment areas, these areas would not be treated to prevent adverse impacts from occurring.

Northern goshawk nests have been recorded in coniferous forest on BLM administered lands on the Arizona Strip, however if goshawk habitat was located in a treatment area, the area would not be treated to ensure that no adverse impacts would occur.

Potential habitat for the threatened Mexican spotted owl occurs on the Shivwits Plateau, though no occurrence has been recorded within or adjacent to the region. No treatment would occur in potential Mexican spotted owl habitat. If nests are found during monitoring activities, their location would be recorded and the area would not be treated. It is likely that this species would not be adversely impacted because they are not known to occur in the area, and they generally roost within canyons, which are not located in treatment areas.

No threatened or endangered plants occur on the Shivwits Plateau, though two rare plants are known to exist in the region, the Grand Canyon rose (*Rosa stellata*) and *Penstemon distans*. Trampling and ground disturbance from chemical treatment activities in areas of rare plant species could negatively impact populations on a local basis and plants located in treatment areas could potentially be destroyed. Adverse impacts would be localized and temporary as the herbicides used would have low persistence in the environment and areas where it is known that these plants exist would not be treated.

Cumulative Impacts: No cumulative impacts would occur to threatened and endangered species.

Conclusion: The threatened or endangered wildlife species that may utilize the Shivwits Plateau are birds and therefore generally mobile and able to move away from treatment areas. Since nesting areas would not be treated no adverse impacts would occur in these areas.

The rare plant species on the Shivwits Plateau would not be impaired. Adverse impacts to these species would be localized and temporary.

No impairment to sensitive, threatened, and endangered species would occur as a result of implementing this alternative.

Impact from Alternative D to Riparian Areas: Riparian areas would not be chemically treated so no direct impacts would occur to riparian areas. However soil runoff occurring during or immediately following treatment could deposit contaminated soil in riparian areas having temporary adverse impacts on non-target plants. Since this effect would only impact individual riparian areas and the herbicide used would have low persistence in the environment, impairment of riparian areas would not occur.

Chemical treatment of vegetation could reduce hazard fuel accumulation and prevent a large, difficult to manage wildland fire from occurring in or near riparian areas.

Cumulative Impacts: No cumulative impacts would occur to riparian areas.

Conclusion: Riparian areas would not be adversely impacted by chemical treatment. Removal of vegetation and thinning of hazard fuels could prevent a large, difficult to manage wildland fire, creating moderate beneficial impacts by protecting the riparian areas. No impairment to riparian resources would occur from the impacts of this alternative.

Impacts from Alternative D to Wilderness Areas: Chemical treatment of vegetation could reduce hazard fuel buildup and prevent a large wildland fire and the need for drastic suppression measures, including mechanical equipment, ground disturbance and construction of temporary structures, that may harm the wilderness character and resources.

Although the use of herbicides would likely assist in an eventual return to a more natural ecosystem on the Shivwits Plateau, the natural evolutionary process of the ecosystem did not

include chemicals. Therefore the use of herbicides in numerous vegetation treatment areas would be introducing an unnatural process, possibly altering the wilderness characteristic of the area.

There is the potential that the use of chemicals in wilderness areas could be considered an inappropriate activity which could alter the wilderness character of the area and could potentially create moderate to major negative impacts.

Cumulative Impacts: No cumulative impacts would occur to wilderness areas.

Conclusion: Chemical treatment of vegetation could protect wilderness areas from impairment by reducing hazard fuel buildup and possibly preventing a large, difficult to manage wildland fire, which could result in drastic suppression measures that could further harm the wilderness character and resources.

The use of herbicides in numerous vegetation treatment areas would introduce an unnatural evolutionary process and could alter the wilderness characteristic of the area. This could produce moderate to major adverse impacts to how certain visitors perceive the wilderness resource. However, eventually, the evidence from chemical treatment would fade, therefore, no impairment to the overall wilderness resource would occur as a result of this alternative.

Impacts from Alternative D to Grazing: Chemically treated areas would be closed to grazing activities for 1 to 2 years following treatments to allow for habitat recovery. Temporary adverse impacts would occur to grazing activities as they would be suspended, however long-term impacts would be beneficial as the range would improve due to the creation of vegetation mosaics, the elimination of excess sagebrush and pinyon-juniper, and the growth of grasses and forbs after the fire.

Cumulative Impacts: A vegetation treatment program would improve overall grazing conditions.

Conclusion: Temporary minor to moderate adverse impacts would occur to grazing; however, a vegetation treatment program would have long-term moderate beneficial impacts on grazing activities as grasses and forbs would be allowed to reestablish in grazing areas. No impairment to grazing would occur from the impacts of this alternative.

Impacts from Alternative D to Air Quality: Air quality could be temporarily adversely impacted by chemical vegetation treatment if the vegetation debris was burned. Smoke could have temporary adverse impacts to air quality in the immediate area of the burn, as well as in adjacent BLM and NPS administered lands. Fine organic and inorganic matter (particulate matter) such as ash, dust, and soil, less than 10 microns in diameter could be elevated locally on a temporary basis. These hazards would be minimal to the general public considering the remoteness of the Shivwits region. Fire crew members would be temporarily impacted by inhaling smoke and particulate matter. This is considered an inherent risk in firefighting. Prevailing winds and other weather factors would determine whether smoke from a debris burn affects air quality.

elsewhere. Smoke could temporarily affect Grand Canyon NP air quality, a Class I airshed, and points further east.

Cumulative Impacts: No cumulative impacts would occur to air quality.

Conclusion: If chemically treated vegetation was burned after treatment, air quality would be temporarily impacted in the local area. Prevailing winds and other weather factors would determine the extent of these impacts. If several debris burns occur within the region concurrently, air quality of the Grand Canyon NP would be negatively impacted. Even though this impact is short-term and temporary, decreased visibility in the Grand Canyon could create a major impact in that area. Overall, the air quality in the region would not be impaired by a chemical vegetation treatment program.

Impacts from Alternative D to Scenic Quality: Debris from chemically treated vegetation that is burned after treatment could burn for more than several days, and smoke from these fires could have temporary adverse effects on scenic quality in the area of the burn. Prevailing winds and other weather factors would determine whether smoke from a debris burn impacts scenic quality elsewhere. Smoke could temporarily impact Grand Canyon NP scenic quality, and points further east.

Dense, even-aged stands of vegetation, including grasses, sagebrush, pinyon-juniper, and ponderosa pine would be chemically treated and removed, opening up the viewshed and creating uneven-aged stands which provide a more natural appearance.

Cumulative Impacts: Chemical treatment and removal of vegetation could thin out dense, unnatural looking, even-aged stands of vegetation, improving the viewshed and resulting in a more natural scenic setting throughout the Shivwits Plateau.

Conclusion: Chemical treatment could moderately impact the scenic quality of that area. Scenic quality would be temporarily impacted by smoke during debris burns and prevailing winds and other weather conditions would determine the extent of this impact. Dense, even-aged stands of vegetation would be treated and thinned, opening up the viewshed and creating a more natural skyline. No impairment to scenic quality would occur as a result of this impacts from this alternative.

Impacts from Alternative D to Cultural Resources: The effect of chemical treatments on cultural resources is poorly understood. Therefore, chemical treatments would not be used on and around cultural resource sites. All areas to be avoided would be temporarily marked to prevent work crews from treating the areas. All temporary markings would be removed prior to the work crews leaving the area. If previously unknown cultural resources are located during the treatment activities, the area would be temporarily marked and avoided to prevent damage to the resources. All post treatment activities, such as stacking and burning of dead vegetation, would avoid cultural resources.

Secondary impacts from chemical treatment would include erosion due to lack of cover around and within sites, and increased visibility could lead to increased vandalism to sites.

Cumulative Impacts: No cumulative impacts would occur to cultural resources.

Conclusion: Known cultural and historic resources would not be impacted from chemical treatments and removal of vegetation as these areas would not be treated. Unknown cultural and historic resources could be impacted by trampling or ground disturbance, however upon discovery, further disturbance would be prevented in these areas. An indirect impact to cultural resources would be increased exposure from potential soil erosion after vegetation removal. There would be no impairment to cultural resources under this alternative.

Impacts from Alternative D to Visitor Use: During chemical treatment activities, including vegetation removal, either by haul out or burning, the area perimeter would be closed to visitor access. Visitor use would be temporarily impacted and visitors would be directed to alternative use areas. This could create minor impacts to visitor use as not all areas would be available.

Cumulative Impacts: No cumulative impacts would occur to visitor use.

Conclusion: Visitors use patterns would be temporarily impacted and impacts would be localized to the chemical treatment area. Overall, visitor use in the area would not be impaired as a result of the impacts of implementing this alternative.

Impacts from Alternative D to Safety: Chemical treatment and removal of vegetation could reduce the accumulation of hazardous fuels, increasing prevention of a large, difficult to manage wildland fire and reducing the safety threat that would result from such a fire.

Aerial spraying in mountainous areas with large trees could threaten safety of the aircraft operators as aircraft would have to fly low in order to be effective and reduce drifting of chemicals. On the ground spraying techniques could threaten the safety of the work crew if chemical containers would leak, exposing members of the work crew to direct contact with hazardous chemicals. These would create moderate impacts to the safety of these crews.

Cumulative Impacts: No cumulative impacts would occur to safety.

Conclusion: Overall, safety would not be impaired but moderate adverse impacts could occur. Aerial spraying operations could adversely impact the safety of aircraft operators due to the need for aircraft to fly low through mountainous, forested terrain. Hand applications of chemicals could threaten the safety of the work crew if container leakages would occur, exposing crew members to direct contact with a hazardous chemical. If required guidelines are followed, it would reduce the risk associated with the use of chemicals. No impairment to safety would occur as a result of this alternative.

Impacts from Alternative D from Recreation Area Operations: If a chemical treatment plan is approved, the recreation area would need to have adequate staff, equipment, and training to safely and legally carry out the functions of the program. This could require a temporary increase in current staff levels.

Cumulative Impacts: No cumulative impacts would occur to recreation area operations.

Conclusion: An increase in staff, equipment and training may be required to accomplish a chemical vegetation treatment program. No impairment to park operations would occur as a result of the impacts associated with this alternative.

COORDINATION AND CONSULTATION

A press release was distributed in February 2001 requesting information on issues related to the fire management program at Lake Mead NRA. No comments were received.

Public notice of the availability of this environmental assessment was published in local newspapers. Individuals and organizations could request the environmental assessment in writing or by phone. The environmental assessment was circulated to individuals, businesses, and organizations on the park's mailing list for a 45-day public review period.

This document was prepared by Kris Meredith, Concessions Management Specialist, and Nancy Hendricks, Resource Management Specialist, National Park Service, Lake Mead National Recreation Area.

The following persons and agencies were consulted during the preparation of this environmental assessment.

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The Paiute Indian Tribes of Utah Consortium.

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GLOSSARY OF ACRONYMS

BLM – Bureau of Land Management
CEQ – Council of Environmental Quality
CFR – Code of Federal Regulations
DO – Director's Order
GCPNM – Grand Canyon Parashant National Monument
GMP – General Management Plan
NEPA – National Environmental Policy Act
NP – National Park
NPS – National Park Service
NM – National Monument
NRA – National Recreation Area
RM – Reference Manual
RMP – Resource Management Plan

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APPENDIX A

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Appendix A: Prescribed Fire Plan

Following is an outline of the minimum requirements for a Prescribed Fire Plan.

1. A description of the prescribed fire area, including a map.
2. The goals and objectives including the purpose of the burn, resource management goals, and the specific objectives of the fire stated in measurable terms.
3. A range of acceptable results expected, expressed in quantifiable terms.
4. A project assessment identifying the complexity of the prescribed fire and a risk assessment that discusses the probabilities of success and consequences of failure for the prescribed fire.
5. Prescribed fire implementation actions including:
 - Pre-burn considerations, on and off-site, defining the line to be built, snags to be felled or protected, equipment to be pre-positioned, special features to be protected, warning signs to be placed, weather recording and monitoring needs, and responsibility and timeframes. Other considerations could include National Environmental Policy Act (NEPA) compliance, public information, air quality requirements, logistical concerns, and pre-burn monitoring.
 - A briefing identifying and analyzing the safety hazards unique to the individual prescribed fire project and specifying personnel safety and emergency procedures. Briefings should also include requirements for use of personal protective equipment. If aerial ignition devices will be used, an Aerial Ignition Operation Hazard Analysis and an Aviation Operating Plan, including firing map and primary/secondary aircraft landing sites, are also required.
 - Provisions for a test fire and recording the results. The test fire must be ignited in a representative location within the prescribed fire areas to test key fire behavior characteristics prescribed to meet management objectives.
 - A prescribed fire prescription containing key parameters needed to achieve desired results. Prior to ignition, prescription elements are required to be compared against local weather forecasts and any other predicted conditions. The same level of authority required for plan approval is required to approve any changes to prescriptive parameters.
 - Describe public and personnel safety and emergency procedures. Procedures include a specific statement that all personnel who are within the active burn areas will have personal protective equipment. Safety hazards on the burn, measures taken to reduce those hazards and EMS personnel on the burn are required to be included. Emergency medical procedures, evacuation routes, and emergency facilities to be used are also required to be included.
 - Staff organization for the burn including required management personnel and their job duties, the number of crew personnel that are needed. During execution of the burn, personnel numbers may not drop below those originally identified in the plan.
 - An ignition plan describing the necessary ignition operation including firing techniques and patterns. Maps showing firing patterns may be included. Necessary resources, personnel qualification, equipment, and supplies must be listed.
 - A holding plan with provisions for holding actions to maintain the prescribed fire within prescription. Firing, holding, patrol and mop-up procedures are required.

6. Provisions for interagency and intra-agency pre-burn coordination and, where applicable, public involvement and burn day notification to appropriate individuals, agencies and the public.
7. A contingency plan identifying actions to be taken if the fire exceeds prescription parameters and/or line holding capabilities and cannot be returned to prescription.
8. The source of funding and estimated costs.
9. Smoke management requirements describing how the project will comply with county, state, tribal, and federal air quality regulations. If taken, modeling outputs and mitigation measures to reduce the impacts of smoke production should be included.
10. Provisions for post-burn evaluation to enable resource managers and the agency administrator to determine if project objectives have been met. Document burn day conditions, fire behavior smoke dispersal, first order fire effects, and cost per acre of treatment. Specify the weather information (forecast and observed) required during all phases of the project, the procedures for acquiring it, including when and by whom, and if spot weather and smoke dispersal forecasts need to be requested. In addition to short-term monitoring to document the results of a burn, long-term monitoring is also required. Permanent photo points, transects, or plots which are revisited in years following a burn will provide information on successional trends, which result from the burn. Longer term monitoring may be necessary to determine if objectives were met. Some trends, such as invasion by exotic species, might suggest the need for a change in the prescription or method of treatment.

APPENDIX B

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APPENDIX B: Monitoring Plan



NATIONAL PARK SERVICE LAKE MEAD NRA



draft FIRE EFFECTS MONITORING PLAN 2002

DRAFT

Prepared by:	Henry Bastian	Date:	_____
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Reviewed by:	Linda Kerr	Date:	_____
	Fire Ecologist, Intermountain Regional Office		
Recommended by:	_____	Date:	_____
	Assistant Superintendent, Lake Mead NRA		
Approved by:	_____	Date:	_____
	Superintendent, Lake Mead NRA		

I. INTRODUCTION / SUMMARY

The primary purpose of the fire effects vegetation-monitoring program is to study the response of dominant vegetation types to fire. Monitoring is needed to provide scientifically based data to guide management decisions and inform the public. Specific plant communities will be identified for monitoring given resource objectives and as the program grows to encompass new areas. Some of these are: ponderosa pine (*Pinus ponderosa*), tamarisk (*Tamarix ramosissima*), and pinyon/juniper (*Pinus edulis & monophylla* and *Juniperus osteosperma & scopulorum*) with Utah Juniper being the dominate tree in this community.

The monitoring protocols of this plan describe the purpose, methods, plans, and goals for fire effects monitoring. The focus of fire effects vegetation-monitoring is to evaluate the Lake Mead prescribed fire program, to verify that objectives are met or discover issues that need to be addressed. Monitoring will allow Lake Mead management to track changes over time and validate research dealing with fire effects and fire ecology. By tracking changes in the vegetation, trends will be identified that will assist in determining and modifying management decisions.

Many ecosystems have evolved and adapted to fire. For example, frequent, low intensity, surface fires were common in ponderosa pine ecosystems, whereas fires in big sagebrush were probably less frequent, of higher intensity, and resulted in sagebrush mortality. Despite this variability in fire regimes, universal principles and processes govern response of ecosystem components to fire.

The effects of fire on ecosystems vary depending on many factors. Some of which include the vegetation type and structure, topography, hydrology, and weather. A fire may have different effects upon the same site if it occurs in different seasons or with different fuel conditions. Therefore it is important to document characteristics of the fire and conditions under which the fire occurred to adequately evaluate fire effects.

Lake Mead NRA recognizes that a natural fire regime cannot be perpetuated in unnatural communities. Fire management decisions on a landscape scale must include information from the past and present in order to manage and preserve natural functioning ecosystems.

II. History

Fire effects vegetation-monitoring began at Lake Mead NRA in 1996 with the Twin Point burn unit.

III. Description of Ecological Model

1999 A. Description of vegetation communities and relationship to fire

Ponderosa Pine (*Pinus ponderosa*)

GENERAL BOTANICAL CHARACTERISTICS:

Interior ponderosa pine is a medium to large sized, long-lived, drought tolerant, wind firm, winter hardy, fire resistant, native, monocious, evergreen, coniferous tree. Although tree heights of var. *scopulorum* may range from 50 to 115 feet (15 to 35m) (Krugman & Jenkinson 1974), 100-foot (31m) heights are attained only on better sites (Lanner 1984).

SITE CHARACTERISTICS:

Widespread throughout the Rocky Mountain Region, interior ponderosa pine grows under a variety of physiographic, edaphic and climatic factors. Generally stands are best developed at elevations between 4,000 to 8,000 feet (1,220 to 2,439m) on steep south and west aspects and also on benches and plateaus (Fowells 1965). This species is adapted to areas receiving mean annual precipitation of 15 to 25 inches (37.5 to 62.5cm), extensive portions of this region fail to support stands of ponderosa pine due to unfavorable patterns in precipitation distribution (Barrett 1962). Ponderosa pine is strongly drought resistant, especially during the seedling stage, and can survive on sites too dry for other conifer species (Barrett 1962). Sites are most often characterized by low soil moisture and high surface temperatures at some time during the growing season (Fowells 1965).

SUCCESSIONAL STATUS:

Ponderosa pine comprises a climatic climax throughout much of its range, typically forming a belt of pure stands which often comprises the lower elevational limits of forested vegetation (Fowells 1965, Schubert 1974). At lower elevations this species gives way to more drought tolerant species such as juniper (*Juniperus scopulorum*, *J. osteosperma*, *J. monosperma*) and pinyon (*Pinus monophylla*, *P. edulis*) and to grassland and shrub steppe community types. Above optimal elevations ponderosa pine may occur as a topographic or edaphic climax on steep, xeric sites; however, with increasing elevation it is usually replaced by Douglas fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*) or blue spruce (*Picea pungens*) (Barrett 1962, Schubert 1974).

PLANT RESPONSE TO FIRE:

Postburn regeneration in ponderosa pine is entirely seedling derived. Fire plays an essential role in encouraging the natural regeneration of ponderosa pine by exposing mineral soil and removing both litter accumulations and competing vegetation. Although bare mineral soil has long been recognized as for seed germination in ponderosa pine (Lowdermilk 1930), the degree to which regeneration is dependent upon fire for seedbed preparation may vary according to geographical region (Crane 1982, Laven et al. 1980).

Basin big sagebrush (*Artemisia tridentata*)

GENERAL BOTANICAL CHARACTERISTICS:

Basin big sagebrush is an erect shrub normally 3 to 10 feet (1-2 m) tall. It occasionally occurs as a dwarf shrub (about the height of *Artemisia nova*) or can be treelike in appearance reaching a height of 16 feet (5 m). It commonly reaches 40 to 50 years of age, and some plants may exceed 100 years. Slow-growing individuals on unfavorable sites attain the greatest age (Blaisdell et al. 1982, Tisdale and Hironaka 1981).

SITE CHARACTERISTICS:

Basin big sagebrush is most often found in deep, well-drained soils in valley bottoms or lower foothill areas. Because it tends to grow in deep, fertile soils, basin big sagebrush is considered an indicator of productive sites. Precipitation on basin big sagebrush sites ranges from 10 to 16 inches (25-40 cm) per year (Beetle 1960, Hironaka et al. 1983).

SUCCESSIONAL STATUS:

Mature stands of basin big sagebrush are considered to be indicators of climax or near climax conditions. Seedling establishment may begin immediately following a disturbance, but it usually takes a decade or more before big sagebrush dominates the site (FEIS 1996).

PLANT RESPONSE TO FIRE:

Basin big sagebrush re-invades a site by soil-stored or off-site seed. The rate of stand recovery depends on the season of burn as it affects the availability of seed, post-fire precipitation patterns, and the amount of competition provided by other plant species regenerating after the fire. Shrubs surviving within the perimeter of a disturbed area provide a more important seed source than those on the perimeter. Where sagebrush stands are dense, fire may stimulate the growth of forage plants and increase their accessibility (Britton et al. 1985, Daubenmire 1975, Johnson and Payne 1968, Zschaechner 1985).

Utah Juniper (*Juniperus osteosperma*)

GENERAL BOTANICAL CHARACTERISTICS:

Utah juniper is a short tree that may live as long as 650 years (Loehle 1988). Utah junipers grow less than 26.4 feet (8 m) and are often as short as 9.9 to 14.85 feet (3-4.5 m), with a trunk 4 to 7.5 inches (10-30 cm) thick (Hickman 1993). Sometimes the tree has multiple stems (Arnold et al. 1964). Utah junipers have a taproot that extends deep into the soil (as far as 15 feet (4.5 m)) and lateral roots that may extend as far as 100 feet (30.3 m) from the tree, several inches below the soil surface. Most root biomass is within the first 3 feet (0.9 m) of soil, with fine roots concentrated in the uppermost 18 inches (46 cm) (Skau 1960), or just below the soil surface (Tiedemann 1987). A Utah study concluded that Utah junipers do not use soil moisture from summer precipitation and do not have active roots in shallow soils layers during the summer (Donovan and Ehleringer 1994).

SITE CHARACTERISTICS:

Utah juniper thrives on very dry sites (Hickman 1993). Precipitation patterns in juniper communities vary, but Utah juniper is generally found in areas of 12 to 18 inches (305-457 mm) of precipitation, with extremes of below 10 inches (254 mm)/year (Pieper 1977) to highs of 20 inches (508 mm) (Springfield 1976). Utah juniper usually occurs in areas with hot, dry summers and cold, wet winters (Balda and Masters 1980), although Utah juniper is also commonly found in areas of summer monsoonal precipitation in New Mexico and Arizona (Springfield 1976). In Utah, Utah juniper is found most often from 5,000 to 7,000 feet (1,500-2,100 m) (Davis and Harper 1990). The upper limits of the pinyon-juniper zone in Utah and northeastern Arizona are from 6,500 feet (1970 m) on north-facing slopes to 8,400 feet (2545 m) on south-facing slopes (Aro 1971).

SUCCESSIONAL STATUS:

Across the West, junipers have expanded their historical range in the years since European settlement (Bradley et al 1991), especially into sagebrush-grass communities below areas of traditional pinyon-juniper (Barney and Frischnicht 1974). Overgrazing, fire suppression, and climatic change have been identified as potential causes of juniper invasion (Springfield 1976). In the absence of fire or other disturbances, trees eventually dominate the site and crowd out herbaceous and shrub species (Arnold et al. 1964). Juniper litter has an allelopathic effect on some understory species, especially Idaho fescue (*Festuca idahoensis*), Sandberg bluegrass, and blue grama (Bradley et al. 1991). Cheatgrass does not appear to suffer from allelopathic effects (Everett 1987).

PLANT RESPONSE TO FIRE:

Utah juniper is usually killed by fire (Barney and Frischnicht 1974). Larger trees, above 4 feet (1.2 m) tall, are capable of surviving surface fires (Springfield 1976). Mortality occurs when 60% or more of the crown is scorched (Springfield 1976). Surface fires will thin a juniper stand to large trees and trees growing on rocks and in other refugia (Crane 1982).

B. SPECIAL CONCERNS

The Lake Mead NRA has no federally listed threatened or endangered plant species. However, there are species of concern including the rare Grand Canyon rose (*Rosa stellata*), which is known to occur near Twin Point on the Shivwits Plateau. It grows in thin sandy-gravelly soils with limestone pebbles overlying Kaibab limestone bedrock in open Great Basin woodland vegetation. *Penstemon distans* is a sensitive plant species that occurs on the northeastern edge of the recreation area. The fire ecology of these species is unknown. In general, *Rosa* sp. resprout after low or moderate fire events, but not enough is known about either of these species to assess fire effects.

Several special status species are known to occur, or could possibly occur in the Shivwits region of the recreation area. Federally threatened bald eagles occur rarely on the Arizona Strip during the winter, using the area as a stop over while in migration. They do not nest in the region. There is potential Mexican spotted owl habitat within the Shivwits Region, though no spotted owls have been recorded. The federally threatened Mexican spotted owl inhabits steep, narrow, and hanging canyons with mature, uneven-aged stands of mixed-conifer and pine-oak

forests. Northern goshawk nests have been recorded in coniferous forests on BLM administered lands on Arizona Strip, winter in lower elevations, and are likely to be found within the recreation area. California condors have been introduced to the Arizona Strip and are considered an "experimental essential" population by the U.S. Fish and Wildlife Service. Potential habitat is present for these species on the Shivwits Plateau.

No other sensitive, threatened, or endangered plant or animal species are known to occur in the project area.

Many historical and archeological sites are located in the park. Prior to management ignited prescribed fires, resource management archeological personnel determine the presence of and potential impacts of the prescribed fire by surveying each burn unit and complete the necessary reports, which are sent to the State Historic Preservation Office for compliance.

Long term fire effects vegetation-monitoring activities should not affect these resources; however, if a previously undetected T & E species or cultural sites are discovered during fire effects monitoring, resource management personnel will be advised. Resource management staff work jointly in developing the five-year burn plans and specific concerns will be addressed and covered during this interdisciplinary planning process.

IV. Management Goals

The reintroduction of fire into many of these ecosystems continues to challenge our managerial and scientific skills. While Lake Mead NRA has developed comprehensive planning and programs in fire suppression, and fire use; fire effects monitoring and interpretation of post-fire and long-term fire effects has only recently begun. Program requirements found in the national policy on fire effects monitoring (RM-18, Ch. 4) states that: "In order to evaluate resource management and fire management objectives, units must monitor the effects of fire." The national recommended standard is the National Park Service, National Fire Monitoring Handbook (2000). Goals of the program are to:

- ◆ Verify that burn objectives are met.
- ◆ Document post-fire effects of prescribed fires.
- ◆ Follow trends in plant communities where fire effects are known.
- ◆ Facilitate the sharing of fire-related information.

For fire to return to its role of shaping many of these ecosystems on a landscape scale, a better understanding of the effects of fire on the ecological community and its environment is necessary. In particular, an understanding of the ways in which plant systems are affected by management ignited prescribed fire should allow us to modify our burning prescriptions. This will allow us to more effectively and efficiently achieve our goals and hopefully add some understanding to the intricacies of these ecosystems, as a whole functioning unit in nature. Monitoring should help us answer the questions; How should management be executed? How should these systems be managed?

The approved Lake Mead Fire Management Plan (FMP) identifies the following general goals related to fire effects monitoring and vegetation management. Specific wildland fire management program goals and objectives can be found in the Lake Mead NRA, Wildland Fire Management Plan.

Goals of the Fire Effects Monitoring Program are to:

- ⌘ Support fire management plans to make informed decisions regarding vegetation.
- ⌘ Maintain organized data sets of fire effects observations to be applied for numerous purposes and various internal or external groups.
- ⌘ Confirm that conditions are within prescription during unit ignition and also assess whether objectives were met within specified prescription parameters.
- ⌘ Assess vegetative conditions and recommend management options to include treatment area, type, objectives, and monitoring or research methods.
- ⌘ Monitor fire effects in vegetation types where there is a lack of data.

V. MONITORING DESIGN & METHODOLOGY

General Discussion:

Lake Mead NRA's FMP mandates that all management ignited prescribed fires must have measurable objectives. Consequently, pre- and post-fire monitoring is necessary to determine whether conditions are within prescription at the time of ignition, and also to determine burn objectives were met. Specific details on the methods and techniques to be used are outlined in the National Fire Monitoring Handbook (FMH). General details will be outlined in this plan. Any differences, deviations, or modifications from the handbook will be noted here and in subsequent end of season reports or workload analyses.

The protocols outlined in the FMH will be followed. Plots will be sampled pre-burn, post-burn, one, two, five, ten, and twenty-years. This schedule of assessments will be followed barring a fire occurring in the area and on the plot(s). During the immediate postburn visit the following information will be sampled: fuel load, burn severity variables, overstory tree severity, and photos taken. This is a deviation from the protocols. The following forms will be used. A FMH7 Photographic index Data Sheet, FMH20 Forest Fuels Inventory data sheet, FMH21 Overstory Tree Postburn Assessment, FMH22 Forest Plot Burn Severity, and FMH24 Brush/Grass Land Plot Burn Severity data sheet. The protocols recommend sampling seedlings, poles, brush and herbaceous. This information has proved to be impractical to sample immediately post burn due to the difficulty in determining if plants are dead or alive for seedlings, poles, and brush and the limited degree of herbaceous plants. At the one-year sample and following intervals, these components of data collection will be done.

Since the program is primarily funded to do monitoring and not research, control plots will be installed only under the direction of local resource and fire managers with regional regulation and management if ecological conditions warrant this need.

All plots are recommended to be sampled within two years of being installed or burned. Plots will be sampled at this interval unless burn schedules or priorities change. At that time the plots will be evaluated if they will remain in the system or be removed. In the event that the decision is made to remove the plot\;s, the plot\;s will remain intact until the year five reading at which time the plot\;s will be sampled and the data will be used as control data for monitoring type treatment

comparison purposes. After this sample the plot/s will be evaluated to determine if they will remain in the monitoring type system, due to changes in burn schedules, or removed.

Baseline data from plots will be analyzed in order to determine treatment priorities, objectives, and protocols. This data will also be analyzed to measure pre- and post-treatment changes over time. Establishing and reading plots over several years should minimize effects attributable to weather. Through fire effects monitoring, vegetation trends and responses can be observed that will assist in refining and improving objectives and treatment options. One monitoring type will be explained in detail in section B. Sampling Design – Ponderosa Pine Monitoring Type.

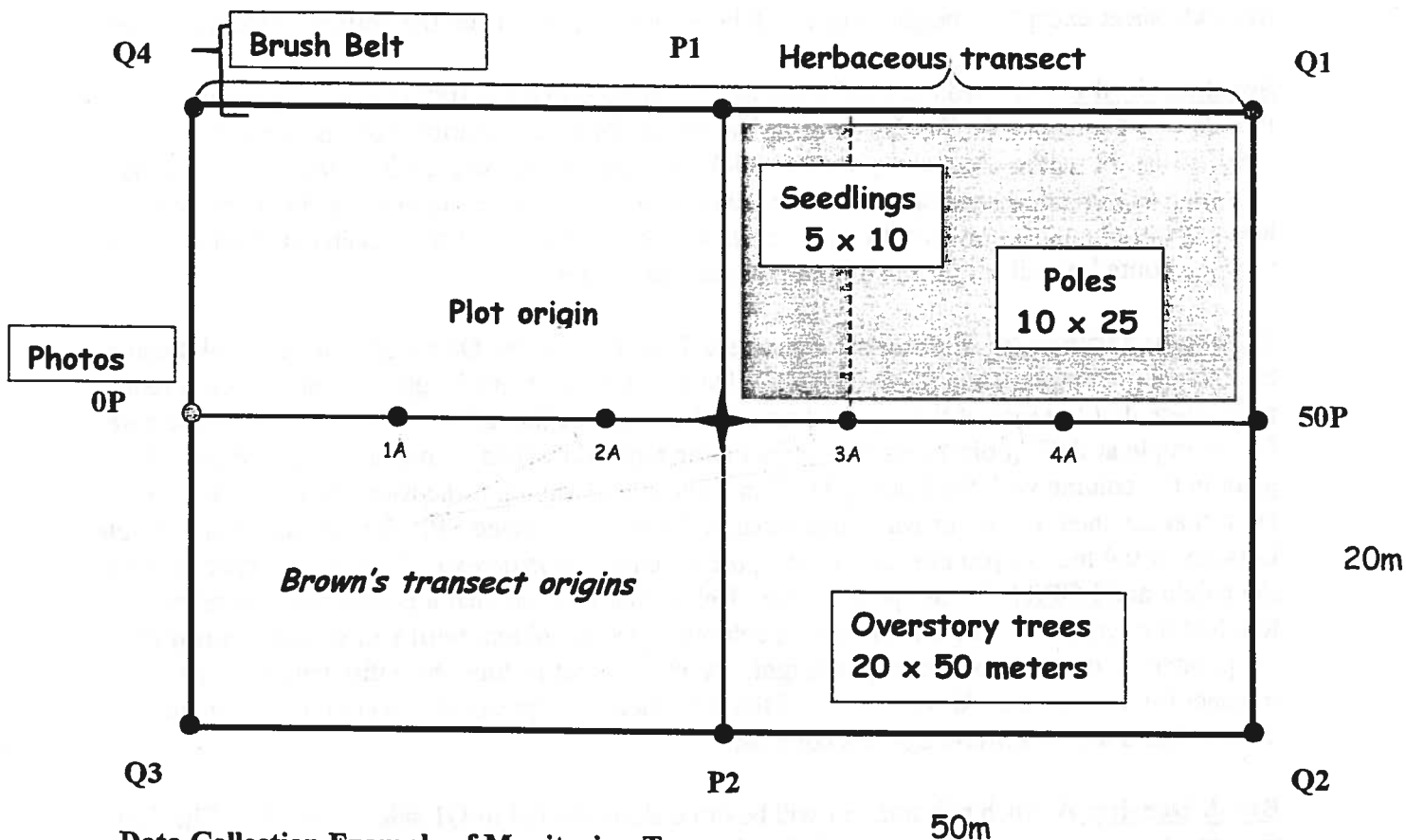
A. Monitoring Objectives:

Monitoring objectives and precision levels will vary depending on vegetation type. These objectives are used to verify that burn objectives are met within the monitoring or vegetation type. Documenting post-fire effects of prescribed fires will allow us to follow trends in plant communities and improve our knowledge and direct our future actions in returning fire to the ecosystem.

B. Sampling Design

Sampling design for fire effects monitoring performed in the areas that the Utah/Great Basin fire effects team covers (Zion, Bryce Canyon, Golden Spike, Lake Mead, Great Basin, Mesa Verde, and Arches-Canyonlands) will follow the protocols listed in the National Fire Monitoring Handbook with the documented changes located in this or other monitoring protocol documents and annual reports.

Plots are placed in burn units randomly using stratified random and restricted random techniques. Random points are put in the units using Geographic Information System, grid map, or XY coordinate methods. Grass, brush, and forest protocols are followed as outlined in the handbook. The diagram below shows the forest plot layout with dimensions and items sampled. Specific details describing procedures for data collection are outlined below for the Ponderosa Pine Monitoring type. The remaining monitoring types are diagramed in Appendix A in their FMH-4 Monitoring Type Descriptions Sheet format. Descriptions on the FMH-4 form include: Methods, sampling size, field location, rejection criteria, acceptance criteria, use of control plots, and the total number of plots to be installed.



Data Collection Example of Monitoring Types

Forest plot protocols are used with a 20 x 50-meter plot design. Plots will be referenced using the index plot location data sheet FMH-5. A species code list will be filled out for each plot. This will include species that are intercepted and those that are not. All headings of data sheets will be filled out completely listing: Plot identification code, circle burn or control plot, Date, Burn unit, Recorders (Full name, Not just the last name), circle Burn status or which visit and then fill out or circle other information specific to the data sheet. The plot will have a total of eight photographs taken following the field of view information outlined on the bottom of the Forest Plot data sheet FMH-7. A 35mm camera will be used and photos will be taken 1.5 to 2 meters from the re-bar stake at an approximate height of 4 feet.

Overstory Trees: Overstory trees will be sampled in each 10 x 25 meter quarter, starting with quarter 1. Overstory trees are 15.1cm DBH and larger. The FMH-8 Overstory tagged tree data sheet will be used, along with FMH-9 the Full plot tree map data sheet. Quarter number will be entered followed by tag number (all overstory trees will be tagged, both live and dead with tags pointing toward the origin of the plot), species code (using the four letter code), DBH, Live or dead, Crown position code, damage codes and any comments.

Pole sized trees: Pole sized trees will be sampled in the 10 x 25m area of quarter 1. Pole trees are 2.51cm to 15.1cm in DBH. The FMH-11 Pole-sized data sheet will be used, along with form

FMH-12, Quarter 1 pole-sized tree map. Pole tree data will be filled out similar to the overstory tree data sheet except for height, which will be a coded number from the bottom of the data sheet.

Seedling sized trees: Seedling sized trees will be sampled in a 3 x 10m subset of quarter 1. (See plot design above and the Fire Monitoring Handbook for more descriptions). Seedling tree data sheet FMH-14 will be used, along with FMH-15 tree map using only the 3 x 10m part of the map. All ponderosa/conifer seedlings will receive their own map number, however gambel oak will be lumped into the most convenient way to circle it or in 1 x 3-meter strips. Each oak seedling stem will be counted or tallied for the different height class codes.

Herbaceous transects: Herbaceous transects will be done on the Q4 to Q1 side of the plot using the 50meter Transect Data Sheet FMH-17. The first column is the height column. Using a tent pole, place it at the side of the tape and record the height of the tallest plant that touches the pole. For example at PNT (point) 1 or 0.3meters on the tape you would record the height of the tallest plant in the column with the heading HGT,m. Then you would put the four-letter code for the plant that touched the rod or was intercepted in the column labeled SPP; for species. For example Lets say at 0.4 meters you intercept or the pole touches *Poa pratensis*. You would write in .4 for the height and POPR1 for the species code. Below that let's say that a ponderosa pine branch touched the tent pole. In the next species column (Species column two) you would record PIPO1 for ponderosa pine without listing its height. Point intercept is done the entire length of the transect for 166 points. At the bottom of the data sheet, list species that were not intercepted. This is also done on FMH-6 Species code list.

Brush Density: A brush belt transect will be done along the Q4 to Q1 side of the plot. The Belt transect data sheet for brush density FMH-18 is used. INT or Interval is the break down of the transect length so you don't have to count all of the brush along the 50 meters. The interval is broken down into 5-meter sections. For the ponderosa pine monitoring type the belt width is two meters wide. Primarily brush will be counted as an individual plant if the stems are rooted to a central location. If they are not then stem counts will be done for counting the brush.

Fuels Inventory: Fuels inventory will be done along the mid-line, OP to 50P, at the 10, 20, 30, and 40 meter marks. Transects will be 50feet long. Re-bar will be installed and tagged per tag labeling and FMH-20 Forest Index Plot Fuel Inventory Data Sheet will be used. As with all other data sheets the heading information will be filled out. Transect lengths, in feet for fuels will be; 1Hour (0 - .25") 6 Feet, 10Hour (.25 - 1") 6 Feet, 100Hour (1 - 3") 12 Feet, 1000Hour (3" + broken into sound or rotten). 1000Hour fuels will be recorded with Diameter in inches written out and broken into tenths of inches. Litter and Duff will be recorded at the 1, 5, 10, 15, 20, 25, 30, 35, 40, and 45 foot marks. Litter is the top layer that has recently fallen. The top of the duff are those fuels that have begun to weather and down to bare mineral soil. Litter and Duff is measured in tenths of inches.

C. Field Measurement

Plots will be measured following the protocols documented in FMH. The plots will be marked with re-bar and labeled with abbreviated brass tags. Suggested forms will be used to

document data, which are listed in the Fire Monitoring Handbook.

D. Timing of Monitoring

Monitoring will be done from May through September, with peak plant phenology occurring during these summer months. When possible the same month will be used each year for the sampling of the fire effects monitoring plots. New plot installations and plot rereads will follow FMH protocols for plot re-reads at; year one, year two, year five, year ten, and year twenty. Depending on the year, some plots may be installed or monitored in April or October due to weather conditions of the year. Immediate post fire reads will be done within one month of the completion of the burn or at the earliest possible time thereafter.

E. Monitoring Plot Locations

Global Positioning System (GPS) will be used to record all plots, and data will be maintained according to protocols of the Lake Mead Geographic Information System (GIS) lab. In the event a GPS reading can not be sampled at the time the plot is sampled, attempts will be made in later years or sample periods to obtain this data. Data will be processed and archived in the GIS lab. Directions for plots will be recorded on form FMH-5 Index Plot Location Data Sheet and kept with each folder. These files will be maintained at Lake Mead and in Zion.

F. Prescribed Fire Monitoring Parameters

Lake Mead NRA has adopted the National Park Service Fire Monitoring Handbook as a guide for fire effects monitoring. Four monitoring levels are identified in the Handbook:

Level 1. Environmental:

These factors provide the basic background information needed for decision-making and include: weather, fire danger rating, fuel conditions, resource availability, concerns and values to be protected, and other biological, geographical or sociological data.

Level 2. Fire Observation:

This level includes reconnaissance monitoring to perform basic assessment and overview of the fire, and fire conditions monitoring to assess the dynamic aspects of the fire. Variables to be monitored include: fire cause and ignition point, fire location and size, logistical information, fuels and vegetation description, current and predicted fire behavior, potential for further spread, current and predicted weather, resource or safety threats and constraints, smoke volume and movement, topographic variables, ambient conditions, fuel model, fire characteristics, smoke characteristics, holding options, and resource advisor concerns.

Level 3. Short-term Change:

Information on fuel reduction, vegetative change, or other objective-dependent variables within 1 to 5 years after a fire.

Level 4. Long-term Change:

Continued monitoring of the Level 3 monitoring type variables to measure trends and change over time.

G. INTENDED DATA ANALYSIS AND MANAGEMENT

Data collection will be directed by the fire effects specialist and or crew leader. Data collection will follow standard operating procedures of data collection following FMH protocols. Other data management will include computer data entry, quality control checks, filing of raw data; development, labeling, and filing of slide film and/or digital copies on disc or compact disc. All data will be entered, corrected, and analyzed at the end of the year and will be formally reported with copies of the report and backed up data sent to the regional office.

Data entry and analysis will be done using the Fire Monitoring Handbook software (FMH.EXE), and ARC/INFO GIS mapping software. Database files will be stored at Lake Mead and at Zion in the Fire Management offices. Copies of all data and data summaries will be sent to Lake Mead.

Through the collection and analysis of the data we will be able to compare our results with other fire effects studies in similar vegetation types that have been conducted. The data will initially be analyzed using the FMH software. Once the data has been analyzed a statistician may be consulted to assist with determining if the data is skewed and normally distributed. Other statistical programs will be used in analyzing the data.

VI. MONITORING IMPLEMENTATION SCHEDULE

A. Burn Unit Schedule

See Environmental Assessment

B. Plot Establishment

Plots will be established following protocols of the NPS National Fire Monitoring Handbook.

C. Pre-burn Sampling

Plots will be sampled following protocols of the NPS National Fire Monitoring Handbook.

D. Post-burn Sampling

Plots will be sampled following protocols of the NPS National Fire Monitoring Handbook. However immediate post burn sampling will include only the Browns fuel load transects, burn severity data collection and the overstory postfire assessment. The rationale for this change is that it is difficult to determine if seedlings, poles, herbaceous, and brush are alive or dead immediately post burn.

VII. DATA SHEET EXAMPLES

See NPS National Fire Monitoring Handbook.

VIII. RESPONSIBLE PARTY

This plan will be prepared by and updated by the Utah/Great Basin Fire Effects Specialist based at Zion National Park. The Intermountain Region Fire Ecologist, Lake Mead Fire Management Officer, Lake Mead Ecologist, and Lake Mead Chief of Resource Management will provide review.

The Fire Effects Specialist is responsible for the following:

- A. Supervising the crew leader and fire effects crew in plot establishment, data collection, data entry, and quality control.
- B. Interfaces with local, regional, and national fire ecologists and resource managers in developing objectives and designing monitoring protocols and area programs.
- C. Program planning, data management, and analysis of fire effects data in coordination with FMO, fire management staff, Chief of Resource management, resource management staff, and Lake Mead NRA staffs.
- D. Present fire effects data and monitoring results in posters, papers, or public presentations.
- E. Planning and preparing budget information.
- F. The specialist does hiring with assistance from the field lead.

The Fire Effects Assistant is responsible for the following:

- A. Directing the field crews in plot establishment, data collection, data entry, and quality control of the data and other assigned duties.

B. Planning travel and logistics for crew assignments.

Identified Fire and Resource Management Personnel will plan projects, develop specific fire and resource objectives, and review projects and objectives following completion of the project.

IX. FUNDING NEEDS ASSESSMENT

FIREPRO funding will be used for fire effects monitoring activities. If specific resource concerns are identified other funding will be needed.

X. MANAGEMENT IMPLICATIONS OF POTENTIAL RESULTS

The Fire Effects Specialist / Fire Ecologist, area Fire Management Officer, Resource Ecologist, and area Chief of Resources will evaluate the fire effects program, fire effects data, and results each year. Data collected in this program will be used to evaluate whether fire management program goals and objectives are being met. Periodically the Intermountain Region Fire Ecologist/Fire Effects Program Coordinator will review the program and results. At times, the National Fire Effects Program Coordinator may be invited to participate in this review.

This review will evaluate whether the objectives were met or are within acceptable parameters, how results compare to treatment prescriptions, and what deviations are seen in the data. If there is a divergence from what was expected, the Lake Mead fire and resource staffs will review the results and determine changes to be implemented with suggestions to the fire effects specialist / ecologist. Regional and area consultants may be involved in the review process. This divergence may identify the need for specific research, a need to modify fire, resource and vegetation monitoring objectives, and changes in treatment prescriptions.

Fire Effects presentations will be done in the park and program information will be presented. Possible items would include evaluating program objectives to see if they were achieved, any observable trends, areas of concern, and needed assistance or further study and research. This presentation will be open to the entire park staff but its main audience will be the Fire and Resource Management staffs. Following each program evaluation, a summary will be prepared, including any changes that need to be made along with what procedures were successful and those that were not. If the data shows that objectives are not being met, alternatives will be considered, including modification of prescriptions or objectives, or conduction of additional research.

Annual end of season report will summarize monitoring data and identify significant changes. The annual reports should be referenced for the latest program information. This information will also help identify long term trends over time that may guide management decisions. These trends might include the influx of non-native plants, the change in wildlife populations, or the high mortality or significant density increase of one species.

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XII. CONSULTATION AND COORDINATION

A number of people contributed to this plan and provided advice and expertise. They are: Elizabeth Anderson, Intermountain Region Fire Ecologist and Program Coordinator for Fire Effects Monitoring; Bob Trodahl, Fire Management Officer Lake Mead NRA; Lisa Bye, Prescribed Fire Specialist, Lake Mead NRA; Kent Turner, Chief of Resource Management, Lake Mead NRA; Curt Deuser, Resource Management Specialist, Lake Mead NRA, and Paul Reeberg, Pacific West Region Fire Ecologist and Program Coordinator for Fire Effects Monitoring;

XIII. APPENDICES

A. FMH4 Monitoring Type Description Sheets.

Ponderosa Pine (*Pinus ponderosa*)

Gambel Oak (*Quercus gambellii*)

Common Sagebrush (*Artemisia tridentata*)

Pinyon/Juniper (*Pinus edulis & monophylla* and *Juniperus osteosperma & scopulorum*)

B. Lake Mead NRA Rare Plant Survey and Vascular Plant Scientific & Common Name List

C. Fire Effects Plot Locations Map

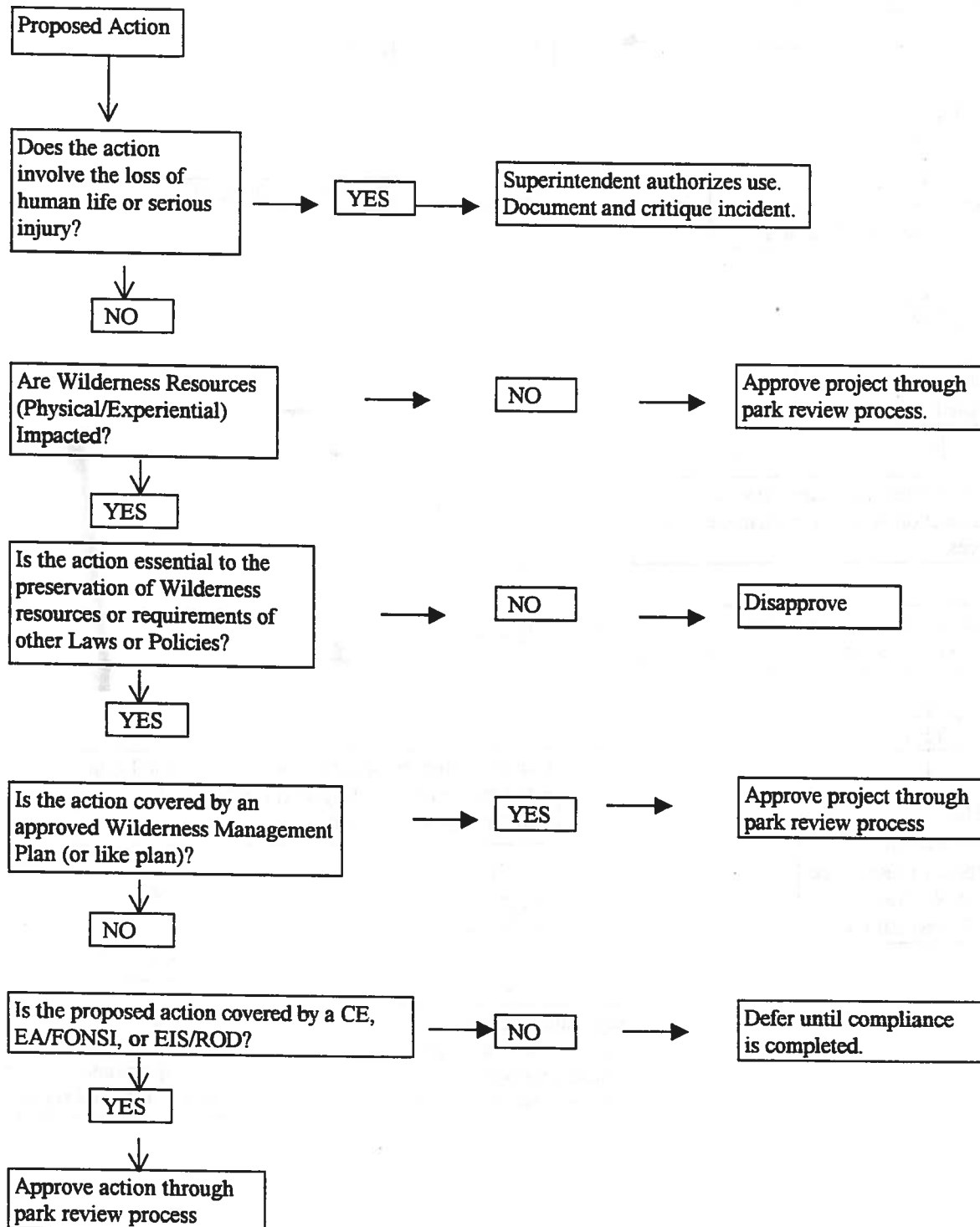
D. Lake Mead NRA Tentative 5 Year burn schedule

APPENDIX C

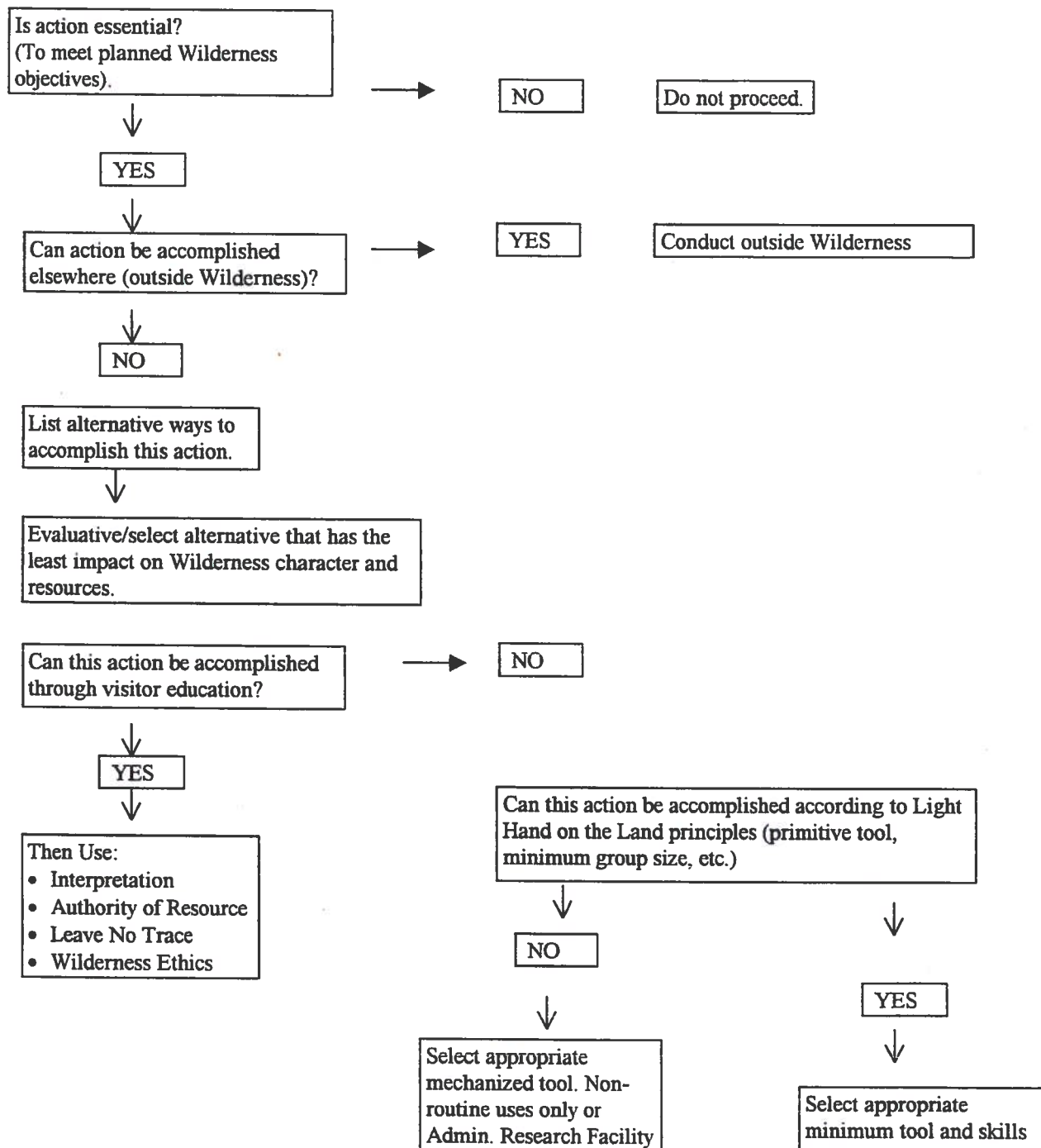
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APPENDIX C: Minimum Requirement Analysis

PART 1



Minimum Requirement Analysis - PART 2



Minimum Requirement Analysis Decision Screening Questions

1. Does your action insure that wilderness is not occupied and modified?
2. Does your action maintain or move the Wilderness toward less human influence within legal constraints?
3. Does your rationale allow Wilderness to retain solitude and elements of surprise and discovery?
4. Did you evaluate the traps of making decisions based on economy, convenience, comfort, or commercial value?
5. Did you look beyond the short-term outputs to ensure that future generations will be able to use and enjoy the benefits of an enduring resource of Wilderness?
6. Does the alternative support the Wilderness resource in its entirety rather than maximizing an individual resource?
7. Do you recognize the unique characteristics for this particular Wilderness?
8. Does the action prevent the effects of human activities from dominating natural conditions and processes.