National Park Service
U.S. Department of the Interior

ZION NATIONAL PARK
UTAH

FIRE MANAGEMENT PLAN

Environmental Assessment/Assessment of Effect

November 2004

This page intentionally left blank

Fire Management Plan
and
Environmental Assessment

ZION NATIONAL PARK

Summary

The National Park Service (NPS) proposes to develop a new Fire Management Plan for Zion National Park, Utah. The plan would guide the wildland fire program by providing management direction that would support the accomplishment of resource management and protection objectives.

Fuel loadings and vegetation densities have increased in some areas beyond their range of natural variability. Some park developed areas and adjacent private lands are now at risk. Additional management intervention is required to reduce fuels that, under severe burning conditions, could threaten life and property, and to restore the role of fire as a natural disturbance across the Zion landscape.

The current 1992 fire plan and the 2001 Zion Wildland Urban Interface Environmental Assessment/Finding of No Significant Impact contain objectives that allow for wildland fires in certain areas to be managed for resource benefits, limited prescribed fires to meet resource objectives, and limited manual hazard fuels treatments involving cutting and thinning to establish defensible space around values to be protected. Unwanted wildland fires are currently suppressed.

The revised Fire Management Plan would provide strategies that include suppression of unwanted wildland fires, expanding opportunities for increasing the use of prescribed fire to meet resource objectives and improving fuel reduction treatments (mechanical fuel reduction and prescribed burning) that would enhance defensibility around structures.

Two alternatives, a no-action and a proposed action/preferred alternative, were identified based on program goals and objectives; internal and external scoping; guidance from existing park plans; policy guidance from the NPS; the 2001 Federal Fire Policy and the National Fire Plan; and research, monitoring, and experience from the existing fire management program.

Alternative A (No Action): Current fire management allows natural fires to influence existing vegetative ecosystems in Zion National Park when they can be contained within park boundaries, except when such fires threaten public or visitor safety, private lands, or structures. The existing plan also recommends that designated areas in the park, mainly on plateaus, be intentionally burned to maintain or re-establish natural vegetative communities and re-introduce fire into fire dependent park ecosystems.

Alternative B (Proposed Action/NPS Preferred Alternative): The proposed action would allow for implementation of the full range of fire management activities, including wildland fire and fuels management. Wildland fire activities would include suppression and wildland fire use for resource benefit. Fuels management activities would include prescribed fire, mechanical, and herbicide treatments. The main focus of these activities and treatments as currently emphasized

by national policy is centered on public and firefighter safety, communities identified as at risk from wildland fires (wildland urban interface), historic fire regime, current condition class, and collaboration with other agencies and stakeholders.

NOTE TO REVIEWERS AND RESPONDENTS

This environmental assessment is available on the Zion National Park Internet Web site at http://www.nps.gov/zion/ and is being distributed for public and agency review and comment for a period of 30 days in accordance with the National Environmental Policy Act. If you wish to comment on the environmental assessment, you can mail comments to the name and address below. Our practice is to make comments, including names and home addresses of respondents, available for public review during regular business hours. Individual respondents may request that we withhold their home address from the record, which we will honor to the extent allowable by law. **If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment.** We will make all submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety.

Please send comments by December 10, 2004 to:

Superintendent
Attn: Fire Management Plan/EA
Zion National Park
Springdale, UT 84767

Table of Contents

TABLES

FIGURES

MAPS

This page intentionally left blank

INTRODUCTION

Purpose and Need

The proposed Fire Management Plan (FMP) analyzed in this Environmental Assessment (EA) would update the 1992 FMP that is currently in use at Zion National Park (hereafter "Zion" or "the park"). The 1992 FMP re-established a natural fire program that began at Zion in 1984 and is proposed to continue in this fire plan.

Historically, fire has played an important role in the ecological development of the landscape we know today in and around Zion. These fires occurred frequently enough to maintain fuel loads at low levels, such that most ignitions had few long-term adverse impacts. Over time, suppression of natural fire has resulted in the accumulation of fuels creating potentially hazardous conditions that threaten human lives and property. These conditions also threaten the natural functions of healthy ecosystems by altering native vegetation.

This plan incorporates relevant management decisions from the Zion General Management Plan (GMP) (2001). The plan also includes fire management policy adjustments expressed in *2001 Federal Wildland Fire Management Policy*, *National Park Service Director's Order–18 – Wildland Fire Management*, *Reference Manual 18 – Wildland Fire Management*; new air quality elements (the *2000 Utah Smoke Management Plan);* and new information regarding park natural and cultural resources. This plan is intended to remain in effect for 10 years, during which time yearly updates are required.

The proposed plan provides guidelines for suppression, prescribed fire, and wildland fire use. Prescribed fires could be used as before anywhere in the park to reduce hazard fuels, restore natural ecological processes, or research fire effects. This plan also proposes to continue to monitor fire effects to determine if goals are being met.

Mechanical fuel reduction would continue to be used as a stand-alone treatment or to reduce fuels to allow for prescribed fire. Wildland fire use would also continue to the extent possible following predetermined prescriptions. Herbicide treatments would be used on a limited basis and only after all other options have been considered, mainly in areas where annual non-native vegetation dominates. Complete descriptions and definitions of fire use strategies can be found under *Alternative B – Proposed Action/Preferred Alternative* and in the *Glossary*.

The purpose of the fire management plan is to provide strategies for management of wildland fires, prescribed fires, and hazardous fuel reduction while protecting human life and property, both public and private. These strategies will protect and conserve the natural and cultural resources of the park for the enjoyment of present and future generations. The Zion GMP identified desired conditions for park resources, which include the continuation of natural processes (including fire) and the ecosystems in which these resources occur. Fire management is a tool used to effectively maintain and/or restore ecological integrity.

In the 1992 FMP, the National Park Service (NPS) identified management strategies and units within the park for the management of naturally ignited lightning fires, prescribed fires, and fire suppression. The understanding and management of fire has evolved over time, and fire plays an important role in sustaining healthy ecosystems.

Current fire management relies heavily on prescribed burning alone and is less aggressive in the use of integrated fuels treatments. Prescribed fires cannot always be accomplished when needed because of

weather and other conditions that cannot be controlled. Continued management as identified in the 1992 fire plan could allow for a buildup of woody fuels, with the associated risk of uncontrolled wildland fire. Because of this, the 1992 FMP is in need of revision. This fire management plan will revise the 1992 FMP.

Location and Description

Zion is located on the southwestern edge of the Colorado Plateau (Refer to Map A). The park lies in portions of three counties in Utah — Washington, Iron, and Kane. The northwest corner of the park is approximately 260 miles southwest of Salt Lake City, Utah. Interstate 15 is located to the west of the park.

High plateaus, a maze of narrow, deep sandstone canyons, and striking rock towers and mesas characterize the park. The lowest elevation in the park, 3,666 feet, is found at Coalpits Wash in the southwest corner. The highest elevation, 8,726 feet, is Horse Ranch Mountain in the Kolob Canyons section.

Zion is surrounded by a mix of federal, state, and private lands. The Bureau of Land Management manages lands that border almost 57 percent of the park. State of Utah school trust lands are found next to slightly less than 8 percent of Zion's border. Privately owned lands surround approximately 35 percent of the park. The lands bordering the park are used for a variety of purposes, including livestock grazing/ranching, recreation, private residences, and commercial uses.

Historical Perspective of Fire

Land Use History

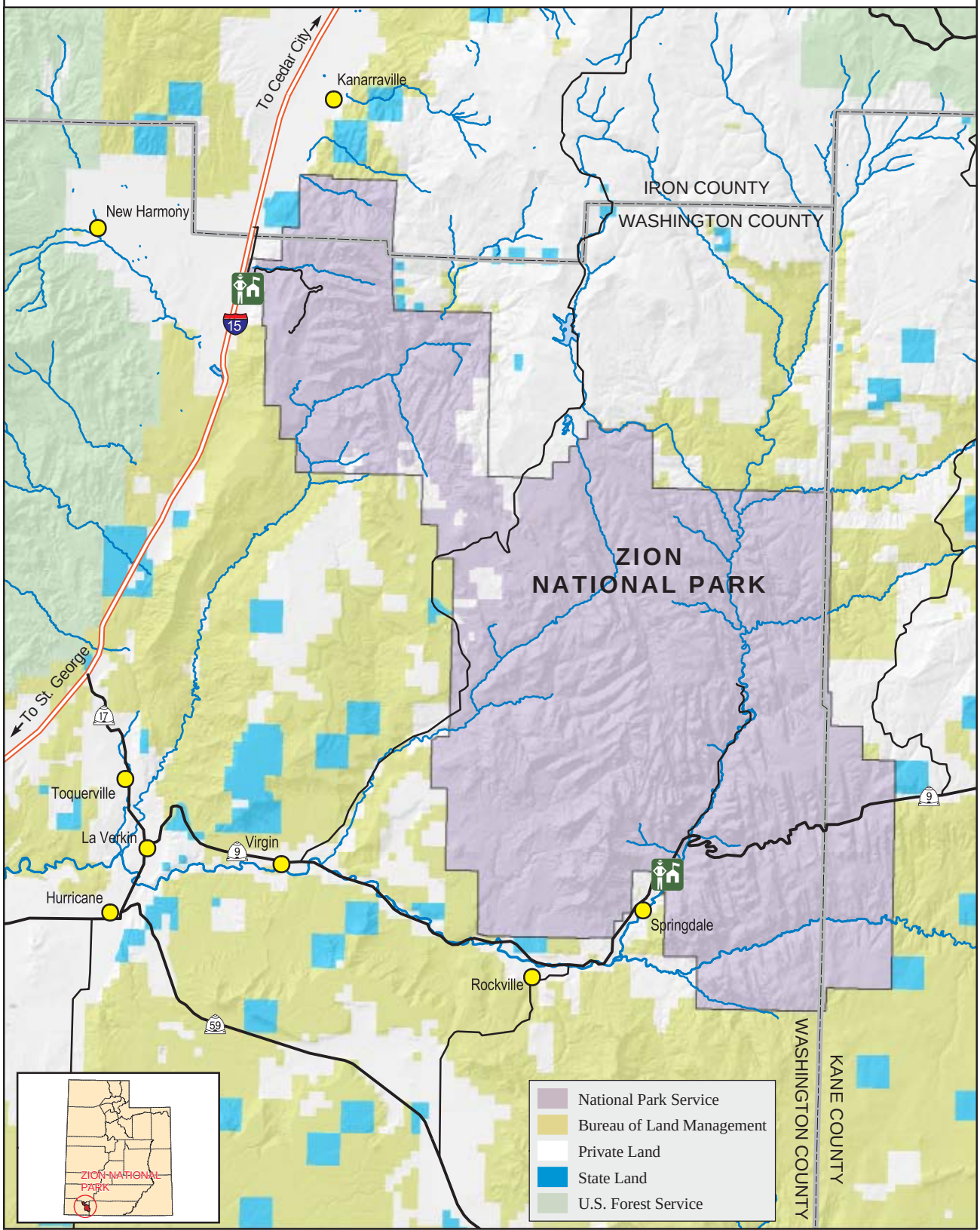
The area within and surrounding Zion has been occupied by humans for over 8,000 years, based on the existing archaeological record. There is evidence that prehistoric human inhabitants hunted game and gathered native vegetation throughout the area. They later cultivated vegetables to supplement their diet. There is speculation that they used fire to manipulate vegetation during these activities, although no definitive evidence exists. This subject continues to be researched and debated.

In 1776, Fathers Dominguez and Escalante, and in 1841, Osborne Russell (a fur trapper), noted that indigenous people deliberately burned grasslands in central Utah. Also, both the Navajo and the Ute are known to have employed deliberate burning to reduce hazards, and improve the habitat and hunting grounds for game species (Stewart 1953). John Wesley Powell (1879) stated that the primary obstacle to the forests occupying their full potential range in Utah was the frequent fires ignited by Indians.

By the early 1860s, Europeans began settling in Zion Canyon. Settlers diverted river water through irrigation ditches to crops in the surrounding floodplains and benches. They grazed cattle, horses, sheep, and goats both in the lowlands and on the plateaus. An NPS report by Mason and Mortensen (1977) stated that the range in what is now Zion was fully stocked by 1875, and problems with overgrazing had occurred in the drought years of 1896-1900.

In the late 1800s and early 1900s, timber stands were logged. Stumps, sawmill remnants, skid roads, and the remnants of a cable works used to lower cut lumber from the plateau to the canyon bottom are evidence of this past land use.

Map A: General Location



Map Projection: Tranverse Mercator,
UTM Coordinate System, Zone 12,
Datum: NAD 1983

Map produced by Zion National Park,
Resource Management & Research, GIS Program

N
W E
S

1:278,250

0 Miles 5

The National Park Service does not assume responsibility for information accuracy, precision, or completeness as displayed on this map.

October 2004

Documented Wildland Fires

Wildland fires are any non-structural fire, other than a prescribed fire, that occurs in wild land. This term encompasses fire previously called both wildland fire and prescribed natural fire. Records of wildland fire occurrences in the park prior to the 1950s either do not exist or are incomplete. Beginning in 1950, wildland fires were better documented. In 1974, an official database was implemented across the NPS to increase the accuracy of fire documentation (Brown, 1974).

Over the past 30 years (1973-2002) the park has averaged 12 fires annually. Based on submitted DI-1202 Fire Reports the park has had 360 fires during that time. A Zion fire history summary can be found in Appendix A and is shown on Map B.

According to NPS policy, all fires were actively suppressed for much of the 20th century. With the implementation of an approved FMP in 1984, wildland fires were evaluated for management of "fire use" for resource benefits within the park, rather than employing a suppression strategy only. From 1984 through 2002, 66 naturally ignited wildland fires were managed for "fire use" for resource benefits, totaling 3,553 acres.

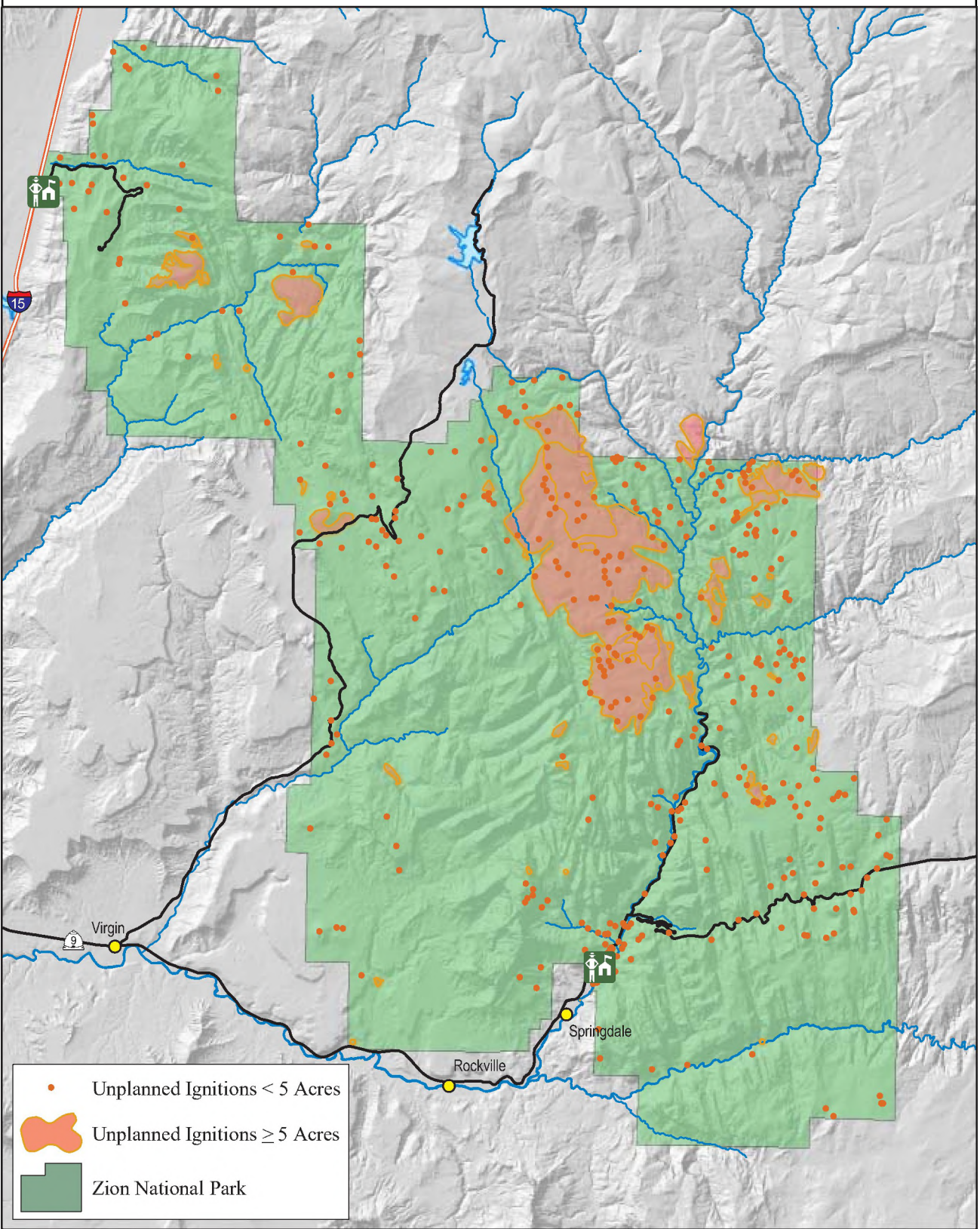
Table 1 summarizes wildland fire activity from 1950 to 2002. Figure 1 displays fire frequency based on all documented wildland fires since 1950 and shows a marked increase in the number of fires after 1974. The park attributes this increase to better detection of fires, increases in fuel loading and vegetation densities that have made the fuels more susceptible to fire ignitions, and fire suppression activities from the 1920s to the 1980s.

Table 1: Summary of Wildland Fires 1950 to 2002

Decade	Total number of fires	Number of ALL fires less than 5 acres	Number of ALL fires greater than 5 acres	Number of wildland fires for resource benefit ONLY	Acres of suppressed wildland fire	Acres of wildland fires for resource benefit	Acres of wildland fire by decade
1950-1959	33	33	0	N/A[1]	0	N/A[1]	0
1960-1969	25	24	1	N/A[1]	25	N/A[1]	25
1970-1979	66	59	7	N/A[1]	142	N/A[1]	111
1980-1989	118	106	12	23	2,830	408	3,238
1990-1999	163	141	22	34	6,414	2,425	8,841
2000-2002	62	56	6	9	440	546	986
TOTAL	467	419	48	66	9,853	3,379	**13,065**

[1] *The 1983 Zion Fire Management Plan* first introduced the management of wildland "fire use" fires for resource benefits; prior to 1983 all wildland fires were actively suppressed according to NPS policy.

Map B: Fire History



Map Projection: Tranverse Mercator,
UTM Coordinate System, Zone 12,
Datum: NAD 1983

Map produced by Zion National Park,
Resource Management & Research, GIS Program

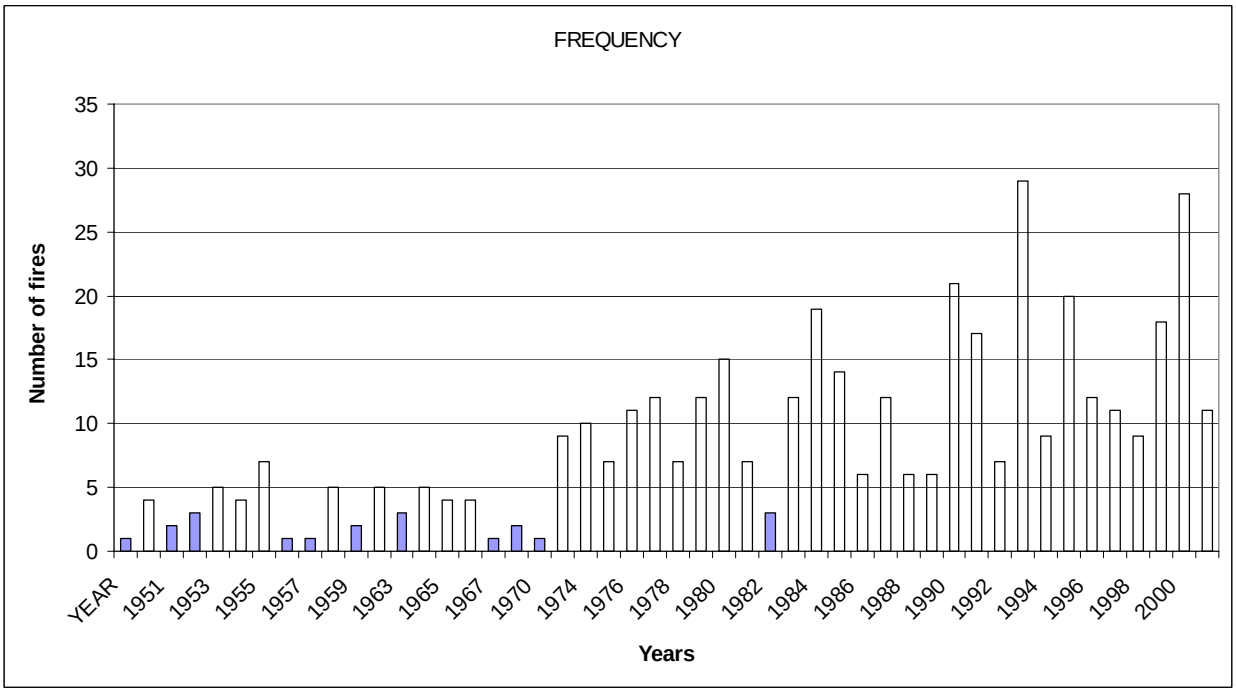
N
W E
S

1:210,000

0 Miles 5

October 2004

Figure 1: Fire Frequency Since 1950 (based on completed fire reports)



Fire History Studies

Fire History Studies in Ponderosa Pine

In 1981, West and Madany researched fire history in ponderosa pine forests within Zion. The research focused on two areas: Horse Pasture Plateau, a large plateau subjected to human influences, and Church Mesa, a small isolated and inaccessible mesa. The research documented a 480-year fire chronology.

Fire scar cross-sections provided evidence of a sharp decline in fire frequency after 1881 on the Plateau. Before this time large fires occurred nearly every three years. The fire frequency of four to seven years derived from this study area fits into the general pattern for studies in other states for ponderosa pine plant communities (West and Madany, 1981). Analysis of fire scars found a fire frequency in 12 watersheds of 2.7 to 25 years prior to European settlement, and fires larger than 960 acres occurred nearly every three years prior to 1881. Sixty-seven of the 123 sample sections contained pith that could be used to calculate the age at which a tree was first scarred. Sixty-four of the trees were ponderosa pine. The remaining three trees were white fir, Douglas-fir, and Rocky Mountain juniper (West and Madany, 1981).

Accordingly, the study by West and Madany (1981) dealt only with areas dominated by ponderosa pine above 6,500 feet — primarily the 9,000-acre Horse Pasture Plateau. The study showed that as slope, exposure, and dryness increased, fire frequency declined. The study found no correlation between climate and fire years.

Snow (1911) surveyed the area around 1911 and commented, "… soil generally gravelly and rocky, … but supports an excellent growth of grasses, especially good on the west side of the canon [i.e. Horse Pasture Plateau]. The timber in this township is mostly pinyon, yellow pine [ponderosa pine], red pine [Douglas fir], and cedar [juniper]; but is mostly scattering."

Alter (1942) cited a description from Priddy Meek's journal. [This description is of the land to the northeast of Zion.] In June of 1852, Priddy described the area as, ". . . Rich soil, plenty of grass and timber . . . so that a team and wagon might be driven any place . . . We traveled three days amongst this timber, which is of the best quality and clear of underbrush." Their findings seem to indicate that the conversion of ponderosa pine savanna into forest cannot be attributed primarily to the absence of fire as widely believed, but may be due to a host of factors (Madany and West, 1984).

West and Madany's (1981) study stated that, "From the fire scar record we can safely state that any location within a ponderosa pine forest burned at least once, and more likely twice, every decade in the time before white settlement." However, the study suggests that the fire frequency on the isolated relict mesas near Horse Pasture Plateau featured an interval of 69 years, which cannot be directly compared due to many factors, such as ignition sources (West and Madany, 1981). The disparity was not explained only by lack of Paiute vegetation burning on Church Mesa; relative sizes of mesa and plateau also have a role. A point on an isolated mesa burns if and only if the mesa itself is struck by lightning, because cliffs are barriers to fire and ignition chances are strictly limited by a mesa's island-like nature; large plateaus can burn miles from an ignition. However, they added that the effects of the difference in fire frequencies cannot be separated from fire use by native peoples. Indigenous inhabitants used fire for various needs, but the amount and significance of its use within Zion cannot be determined — tree rings don't record fire cause. However, circumstantial evidence indicates a drop in fire activity in the 1870s as aboriginal life ways changed. In the study of fire history, researchers discuss the role of indigenous use of fire, livestock grazing, and suppression of fire by pioneers and the NPS. Combined with fewer Paiute ignitions and fire suppression by settlers, fires were removed from the ecosystem as the NPS continued fire exclusion in the 1920s.

From the 1920s to the 1980s most fires were suppressed within Zion. The earliest account of fire control activity on the Horse Pasture Plateau within Zion was found in the Superintendent's Annual Report of 1931: "The other [fire] burned over an area of about fifty acres on the west rim and cost approximately $100 to extinguish." The establishment of a fire lookout at Lava Point in the late 1940s introduced a tighter level of fire control.

Fire History Studies in Pinyon and Juniper

Utah State University researchers West and Loope (1977) cored the largest trees in pinyon-juniper woodlands in Zion to determine the time since the last fire. The average was around 160 years. From this and other evidence, they concluded that fire was too infrequent at lower elevations to warrant detailed research at the time, and that fire was significant only at upper elevations. Therefore, due to funding, time, and limited resources, the fire history studies in Zion focused only on ponderosa pine communities.

Fire History Studies in Southern Utah

Other fire history studies in southwest and south central Utah have been completed. The studies did not compare tree ring data across a larger geographic area, limiting the ability to transpose the data onto other landscapes. The following three studies provide a range of fire frequencies for the general area around Zion.

- A fire history study conducted in the late 1980s in ponderosa pine communities on the Paunsaugunt Plateau found that the fire return intervals ranged from 15 to 18 years. Fire frequencies of individual trees varied from 19 to 46 years on a sample of 14 trees (Stein 1988).
- A fire history study was conducted at Bryce Canyon National Park in the residential area in 1989. This study found a fire frequency of 3 years for the historic period and 10 years for the suppression era in ponderosa pine communities. Data was collected on a sample of 24 trees (Wight 1989).

- A fire history study examined the mixed conifer forests of Bryce Canyon National Park and concluded that the mean fire return interval was 7 years prior to the 1900s and had increased to 45 years since the early 1900s. Data was collected on a sample of 20 trees (Jenkins 1995).

Fire History Studies in the Southwestern United States

The following fire history studies may provide a range of fire frequencies that occurred naturally in vegetation types that are similar to those in Zion.

- A Great Basin National Park study conducted in pinyon-juniper woodlands evaluated 32 tree samples. The data showed a complex and variable fire history that largely took place before 1860 and varied considerably depending on aspect, topography, and ignition source. The study found that the fire return intervals ranged from 15 to 53 years in the pinyon-juniper woodlands. This study further showed that the fire frequencies of individual trees varied from 19 to 46 years (Gruell 1994).
- A Mesa Verde National Park study conducted in pinyon-juniper vegetation types found a fire return of approximately 400 years and a fire return interval of approximately 100 years in the petran chaparral community (Floyd et al. 2000).
- The Rito de Los Frijoles group 1 study conducted on the Jemez Mountain Range in northern New Mexico examined 9 samples. When Swetnam and Basin (1996) further analyzed the data, they found an average fire return interval of 7 years in a ponderosa pine/pinyon-juniper forest ranging in elevation from 6,660 to 6,750 feet. This same analysis looked at fires that were recorded by 25 percent or more of the trees in the sample and found a fire interval between 8 and 24 years, with an average of 16 years.
- A study conducted at Walnut Canyon National Monument in northern Arizona analyzed 18 tree samples. When Swetnam and Basin (1996) further analyzed the data they found an average fire return interval of 3 years in a ponderosa pine/pinyon-juniper forest ranging in elevation from 6,660 to 6,800 feet. This same analysis looked at fires that were recorded by 25 percent or more of the trees in the sample and found a fire interval between 1 and 12 years, with an average of 6 years.
- The Mesita Blanca study conducted at El Malpais National Monument in central New Mexico evaluated 26 tree samples. When Swetnam and Basin (1996) further analyzed the data, they found an average fire return interval of 8 years in a ponderosa pine/pinyon-juniper forest ranging in elevation from 7,370 to 7,420 feet. This same analysis looked at fires that were recorded by 25 percent or more of the trees in the sample and found a fire interval between 8 and 25 years, with an average of 17 years.
- A study conducted on the Chuska Mountain Range in northeastern Arizona on the Navajo Indian Reservation assessed 16 samples. When Swetnam and Basin (1996) further analyzed the data, they found an average fire return interval of 3 years in a ponderosa pine/mixed conifer forest ranging in elevation from 8,800 to 8,900 feet. This same analysis looked at fires that were recorded by 25 percent or more of the trees in the sample and found a fire interval between 2 and 14 years, with an average of 8 years.

Historical Fire Regimes and Current Condition Classes

In order to understand the connection of documented wildland fires to that of fire history it is necessary to understand fire regimes. Fire regimes describe historical fire conditions under which vegetation communities have evolved and have been maintained (Hardy et. al. 1998). Fire regimes describe the frequency and severity of fire events in vegetation communities. Fire frequency is the average number of years between fires. Severity is the effect of the fire on the dominant overstory vegetation, which can be forest, shrub, or herbaceous. The current condition class (defined below) also needs to be considered in order to understand how these historical fire regimes have been altered though past management practices.

Historical natural fire regime data are not exact reconstructions of historical conditions, being defined as conditions existing before extensive pre-Euro-American settlement (pre-1900), but rather reflect typical fire frequencies and effects that evolved in the absence of fire suppression (Hardy et. al. 1998). This document uses the five regimes as defined by Schmidt, et. al. (2002), including fire frequency and severity. They modified Heinselman's (1981) seven fire regimes, which were defined by return interval and fire intensity. Schmidt used a methodology similar to that used by Brown and others (1994), who integrated site characteristics, habitat types, topographic attributes, and vegetation types to map fire regimes. Fire frequency and severity measures were used to determine the departure from historical conditions. One or more activities may have caused this departure: fire exclusion, timber harvesting, livestock grazing, introduction and establishment of non-native plant species, introduced insects and disease, or other management activities. Table 2 describes the classification, fire frequency (fire return interval), severity, and class assumptions for modeling or determining the historical fire regime class. Map C displays the historical fire regimes within Zion.

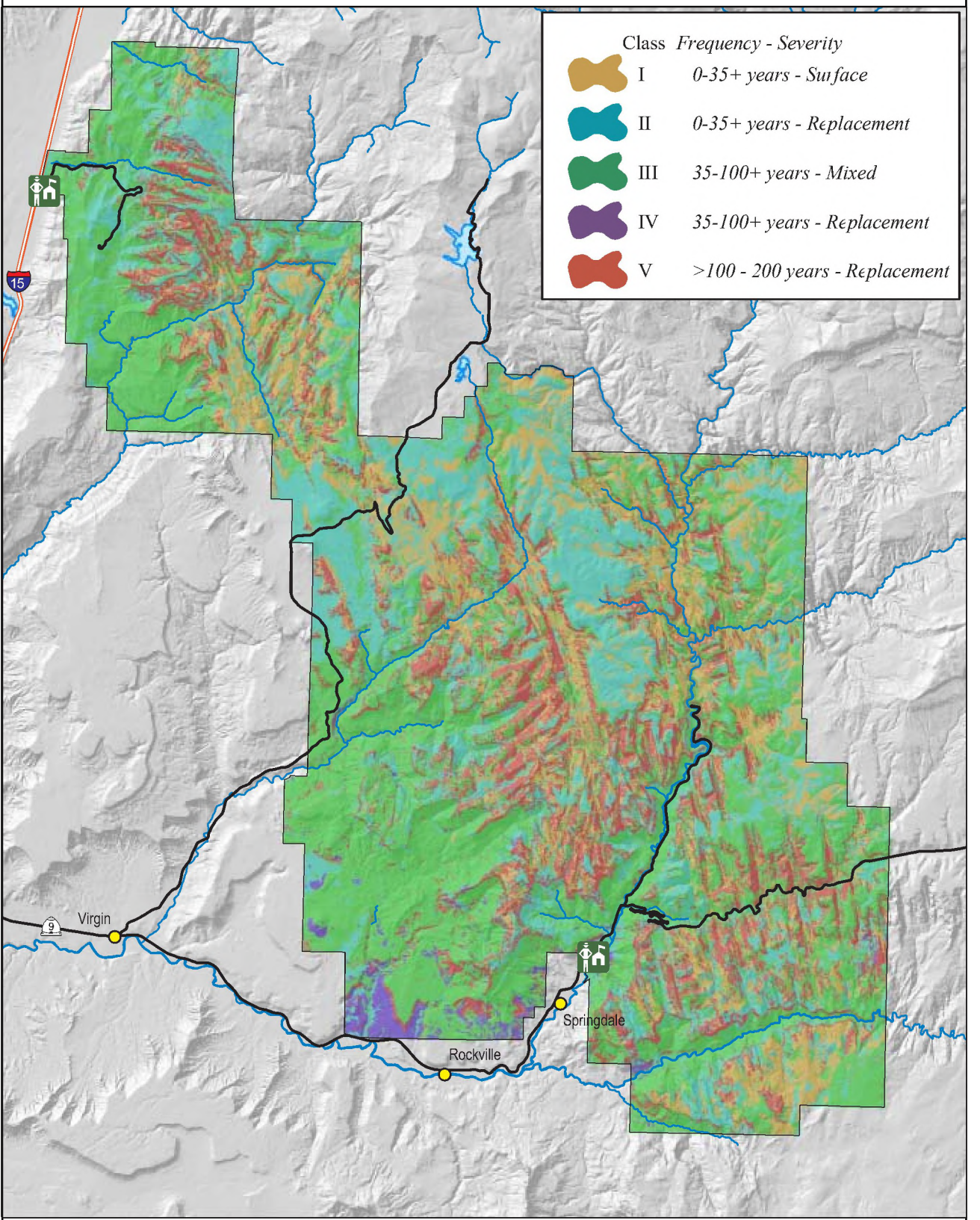
Current condition class is a qualitative measure describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. Data typically shows the degree of departure from historical fire regimes. The classification system includes three current condition classes: 1) fire regimes are within an historical range, and the risk of losing key ecosystem components is low; 2) fire regimes have been moderately altered from their historical range and the risk of losing key ecosystem components is moderate; 3) fire regimes have been significantly altered from their historical range and the risk of losing key ecosystem components is high. Table 3 lists the condition class rating, gives a brief description of the fire regime characteristics, and provides examples of management options that may be used in maintaining or restoring landscapes. Map D displays the fire regime condition classes within Zion.

Table 2: Historical Fire Regime Class Designation

Historical Fire Regime Class	Fire Frequency (fire return interval)	Severity	Modeling Assumptions
I	0 – 35+ years, frequent	Surface	Open forest or savannah maintained by frequent fire; also includes frequent mixed severity fires that create mosaic of different age post-fire open forest, early to mid-seral forest structural stages, and shrub or herb dominated patches (generally < 100 acres).
II	0 – 35+ years, frequent	Replacement	Shrub or grasslands maintained or cycled by frequent fire; fires kill non-sprouting shrubs, such as sagebrush, which typically regenerate and become dominant within 10 – 15 years; fires remove tops of sprouting shrubs, such as mesquite or chaparral, which typically re-sprout and dominate within 5 years; fires typically kill most tree regeneration, such as juniper, pinyon pine, ponderosa pine, Douglas-fir, or lodgepole pine.
III	35 – 100+ years, infrequent	Mixed	Mosaic of different age post-fire open forest, early to mid-seral forest structural stages, and shrub or herb dominated patches (generally < 100 acres) maintained or cycled by infrequent fire.
IV	35 – 100+ years, infrequent	Replacement	Large patches (generally > 100 acres) of similar age post-fire shrub or herb dominated structures, or early to mid-seral forest cycled by infrequent fire.
V	> 100 – 200 years, infrequent/rare	Replacement	Large patches (generally > 100 acres) of similar age post-fire shrub or herb dominated structures, or early to mid- to late seral forest cycled by infrequent fire.

(Hann and Bunnell 2001)

Map C: Historical Fire Regime Classes



Map Projection: Tranverse Mercator,
UTM Coordinate System, Zone 12,
Datum: NAD 1983

Map produced by Zion National Park,
Resource Management & Research, GIS Program

N
W E
S

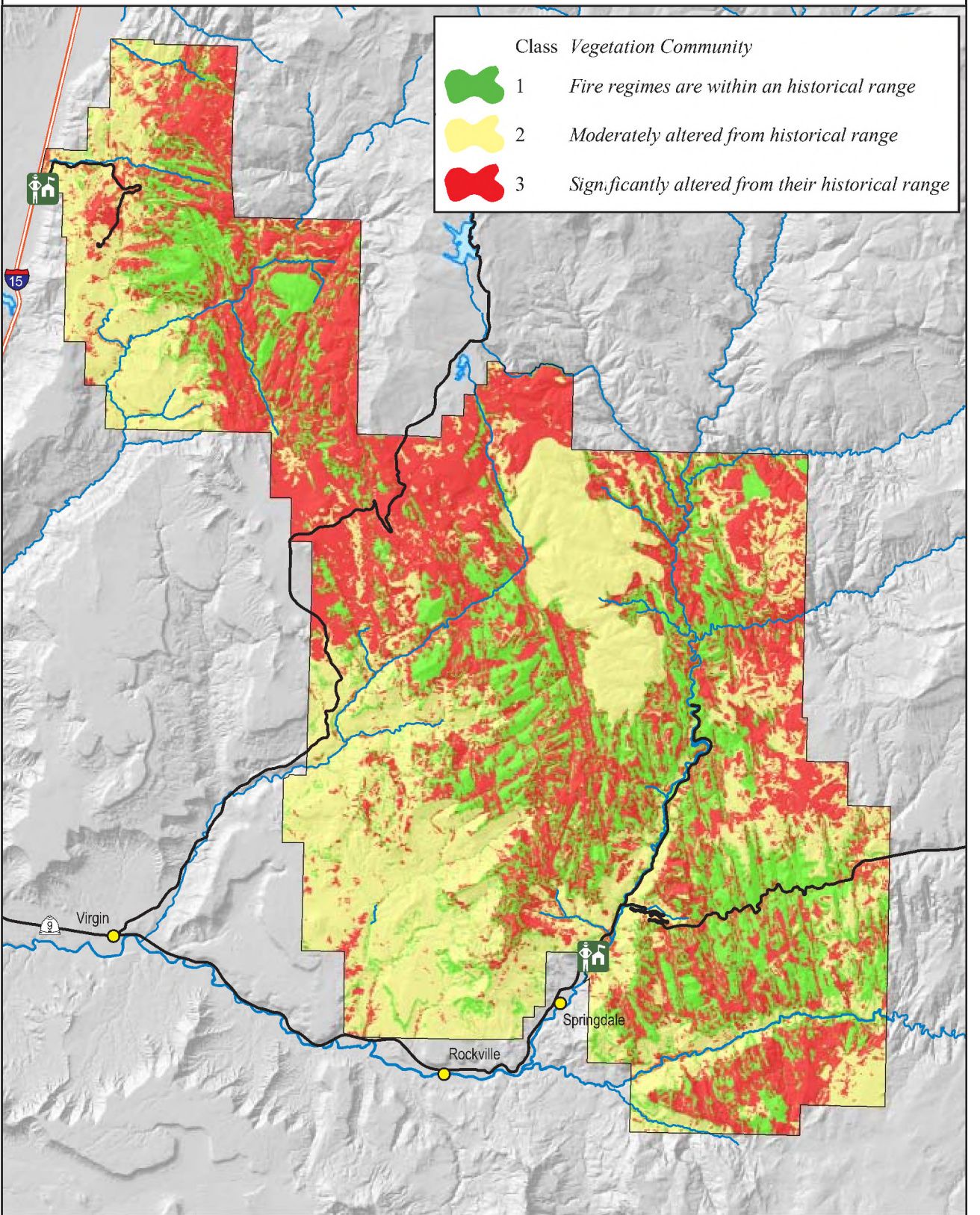
1:210,000

0 Miles 5

The National Park Service does not assume responsibility for information accuracy, precision, or completeness as displayed on this map.

October 2004

Map D: Current Condition Classes



Map Projection: Tranverse Mercator,
UTM Coordinate System, Zone 12,
Datum: NAD 1983

Map produced by Zion National Park,
Resource Management & Research, GIS Program

N
W E
S

1:210,000

0 Miles 5

The National Park Service does not assume responsibility for information accuracy, precision, or completeness as displayed on this map.

October 2004

Table 3: Fire Regime Current Condition Class		
Condition Class	**Fire Regime**	**Example Management Options**
1	Fire regimes are within historical range, and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased), resulting in moderate changes to one or more of the following: fire size, intensity and severity, and/or landscape patterns. Vegetation attributes have been moderately altered from their historical range.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
3	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals, resulting in dramatic changes to one or more of the following: fire size, intensity, severity, and/or landscape patterns. Vegetation attributes have been significantly altered from their historical range.	Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments, before fire can be used to restore the historical fire regime.
Fire Regime Current Condition Class is a qualitative measure describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components, such as species composition, structural stage, stand age, canopy closure, and fuel loadings. One or more of the following activities may have caused this departure: fire suppression, timber harvesting, livestock grazing, introduction and establishment of non-native plant species, introduced insects or disease, or other management activities (Schmidt, K.M., et. al. 2002).		

Vegetation Communities by Historical Fire Regimes and Current Condition Class

The vegetation at Zion and the surrounding area was mapped through a joint project with the U.S. Bureau of Reclamation (USBOR), The Nature Conservancy (Nature Serve), and the NPS. Table 4 shows the major vegetation complexes by historical fire regime class and current condition class. The vegetation communities were combined to these common or dominant vegetation types for this environmental assessment analysis. Table 4 utilizes the vegetation breakdowns described in the *Affected Environment* section, along with the historical fire regime class designation from Table 2. Specific fire history information for many of the vegetation types at Zion has not been developed. The historical fire regime classification is presented here in a general sense to categorize each vegetation type by frequency and severity. Refer to the above descriptions of historical fire regime and current condition class.

Table 4: Vegetation Communities by Historical Fire Regime (FR) and Current Condition Class (CC)[1]			
Vegetation Communities	**Historical Fire Regime Class[2]**	**Current Condition Class**	**Fire History Assumptions and Notes**
Exotic Grasses	II	3	Not analyzed in fire history study at Zion.
Grass/Herb Lands	II	2	Depending on location, vegetation probably burned within the 4 to 7 year time frame as derived from the fire history study. In general, CC 2 with some areas of CC 3.
Wetland/Riparian	III	1	Not analyzed in fire history study at Zion.
Exotic Riparian	III	3	Not analyzed in fire history study at Zion.
Desert Shrublands	IV	2	Not analyzed in fire history study at Zion. In general, FR IV, but some areas may be FR III.
Shrublands	I and II	3	Depending on location, this vegetation probably burned within the 4 to 7 year time frame as derived from the fire history study. FR II for most of this type with some FR I.
Slickrock	N/A and I / III	1	Potentially 4 to 7 years but not analyzed in the fire history study. Due to sparse fuels, FR is more likely III or V.
Mountain Shrub	I and II	3	Depending on location, vegetation probably burned within the 4 to 7 year time frame as derived from the fire history study. FR II for most of this type with some FR I.
Aspen	III	3	Depending on location, vegetation probably burned within the 4 to 7 year time frame as derived from the fire history study.
Juniper/Pinyon Pine	III and IV	2	Not analyzed in fire history study at Zion. In general, CC 2, but there are areas of CC 1 and CC 3.
Ponderosa Pine	I	3	This vegetation burned within the 4 to 7 year time frame as derived from the fire history study.
Douglas Fir	I and III	3	Depending on location, vegetation probably burned within the 4 to 7 year time frame as derived from the fire history study. FR III for most of this type with some FR I.
White Fir	I and III	3	Depending on location, vegetation probably burned within the 4 to 7 year time frame as derived from the fire history study. FR III for most of this type with some FR I.
Soils/Stone Formations	V or N/A	1	N/A. FR V for a rare event and CC 1 for historical range and low risk of losing key ecosystem components.

[1]Historical fire regime and current condition class for each vegetation type was determined using expert knowledge and experience with these vegetation types. The fire effects information system also provided insight into vegetation characteristics and responses related to fire. Since the vegetation types were combined for a common vegetation description, many of the classifications for fire regime and condition class encompassed large cross-sections of specific vegetation descriptions. At this level, some of these classifications are at a very coarse scale. Refined work is needed on these historical fire regimes and current condition classes. The national direction is to map these classifications at the landscape scale (6th code watershed) with plot assessments sampled on the ground and a secondary level is to classify historical fire regime and current condition class by detailed vegetation maps.

[2]Underlined FR roman numerals (ex. II) indicate most of the vegetation falls within this FR.

(Hann and Bunnell 2001; Schmidt, K.M., et. al. 2002; U.S. Department of Agriculture (USDA), 2004)

Legislative History

Mukuntuweap National Monument was designated by Presidential Proclamation 877 in 1909 under the authority of the 1906 Antiquities Act. In 1918, Presidential Proclamation 1435 changed the name to Zion National Monument and added additional acres to the monument. On November 19, 1919 Congress established Zion National Park (41 Stat. 356). The proclamations recognized Zion as "an extraordinary example of canyon erosion" and stated that Zion "is of the greatest scientific interest and contains many natural features of unusual archaeologic, geologic, and geographic interest." Appendix B contains the complete legislative history of Zion.

Purpose, Significance, and Mission Goals

The purpose, significance, and mission goals are key elements that helped shape the management of Zion, including the fire management program. The purposes describe why the park was set aside as a NPS unit. Significance addresses why the park is unique – the cultural heritage and natural features. The mission goals articulate the ideal future conditions the NPS is trying to attain.

The purposes of Zion are:

- Preserve the dynamic natural process of canyon formation as an extraordinary example of canyon erosion.
- Preserve and protect the scenic beauty and unique geologic features, including the labyrinth of remarkable canyons, volcanic phenomena, fossiliferous deposits, brilliantly colored strata, and rare sedimentation.
- Preserve the archaeological features that pertain to the prehistoric races of America and the ancestral Indian tribes.
- Preserve the entire area intact for the purpose of scientific research and the enjoyment and enlightenment of the public.
- Provide a variety of opportunities and a range of experiences, from solitude to high use, to assist visitors in learning about and enjoying park resources without degrading those resources.

Zion is significant for the following reasons:

- Zion's stunning scenery features towering brilliantly colored cliffs and associated vegetation highlighted by a backdrop of contrasting bright, southwestern skies.
- Zion is a geological showcase with sheer sandstone cliffs among the highest in the world.
- The Virgin River – one of the last mostly free-flowing river systems on the Colorado Plateau – is responsible for the ongoing carving of this deeply incised landscape.
- Because of its unique geographic location and variety of life zones, Zion is home to a large assemblage of plant and animal communities.
- Zion preserves evidence of human occupation from prehistoric to modern times, including American Indian sites, remnants of homesteading, and engineering and architecture related to park establishment and early tourism.

Mission goals of Zion are to:

- Provide park visitors educational and recreational opportunities that foster an appreciation of Zion and its resources.
- Ensure that visitor impacts do not impair resources.
- Maintain the resource, including plant and animal communities, at healthy and viable levels consistent with natural processes.
- Manage cultural and physical resources to ensure long-term integrity.

- Ensure that the built environment provides for safe visitor and staff uses in a sustainable and cost-effective manner.
- Ensure that the organization is responsive to employee needs, recognizing the contribution of each individual.
- Foster mutually supportive partnerships with private organizations and individuals to achieve visitor use and resource protection goals.

Relationship to Other Plans

The actions proposed in this document are consistent with the Zion GMP (USDI, NPS, 2001e), which states "Park staff will manage fire to maintain and/or restore ecosystem integrity…" The plan goes on to state "Park staff will carry out prescribed fire to replicate ecological conditions and/or reduce dangerous fuel loading, in a manner that minimizes local effects to visibility from smoke production."

The following plans were identified as being relevant to the development of this Environmental Assessment:

- *Cedar City District Wildland Fire Management Plan*, July 26, 1999, Bureau of Land Management (BLM), Cedar City District. The plan encompasses BLM lands adjacent to Zion.
- *Utah Code – Title 65A – Chapter 08 – Management of Forest Lands and Fire Control and Rule R652-120. Wildland Fire*, effective January 1, 2004, Utah State Legislature. This plan covers State of Utah lands adjacent to Zion.
- *East Zion Community Fire Plan* (in draft), Zion Ponderosa Resort. The plan will encompass the private land east of Zion in the vicinity of the Stave Spring and East Mesa Trails.
- *Camp Kolob Fire Plan for Wildland/Urban Interface* (in draft), August 2003, The Church of Jesus Christ of Latter Day Saints. The plan will cover private property generally located north of the park boundary and east of Lava Point (Oak Valley-51 acres, Camp Kolob-37 acres, Kolob Girls Camp-920 acres).
- *Evacuation and Road Closure Plan,* August 2002, signed by Color Country Fire Management Officers.

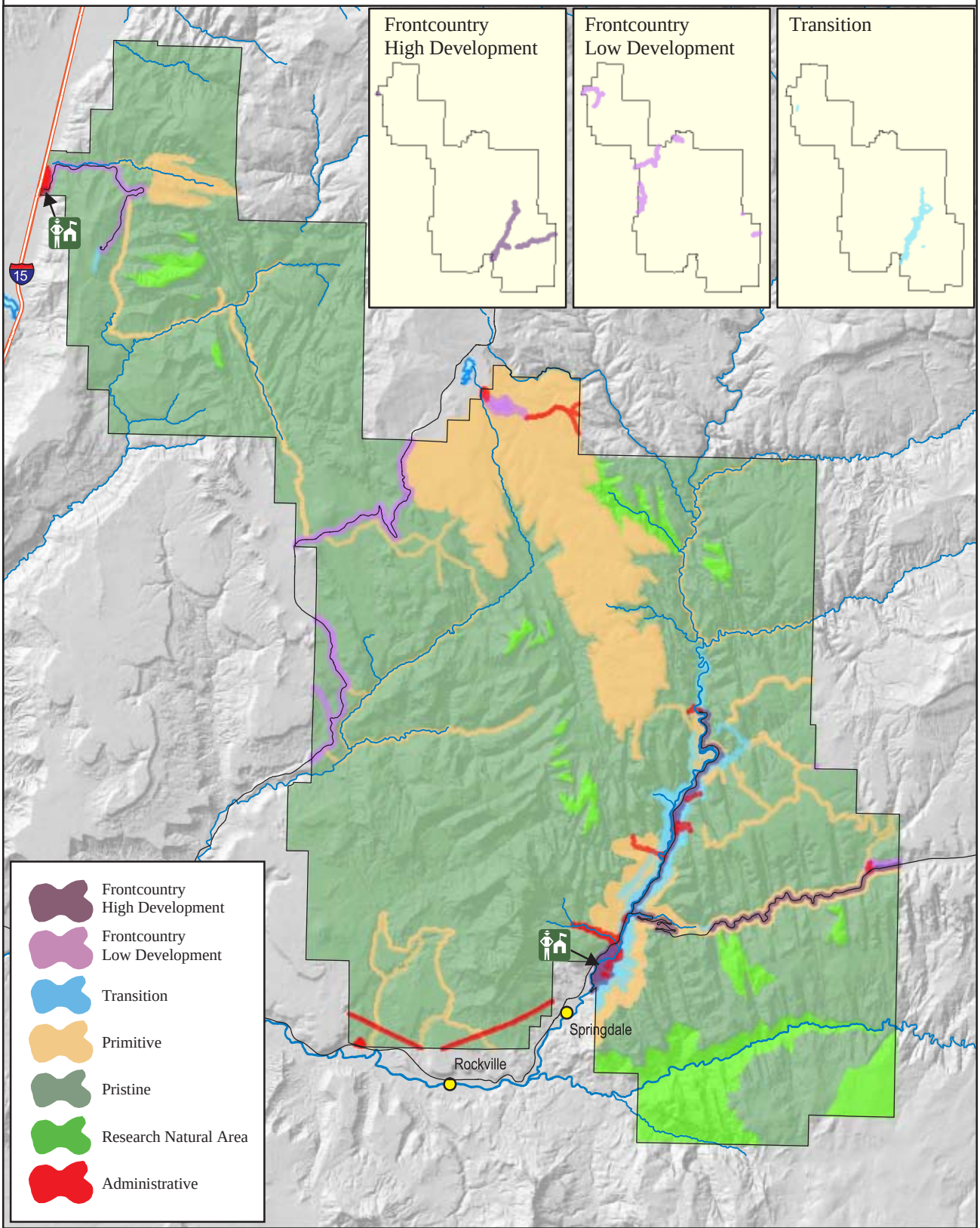
General Management Plan Zones

The Zion GMP (USDI, NPS, 2001e) identified zones that define how different areas of the park will be managed to achieve desired resource and social conditions and to serve recreational needs. The park is divided into seven zones: frontcountry high development, frontcountry low development, transition, primitive, pristine, research natural areas, and administrative (Refer to Map E).

The **frontcountry high development zone** (637 acres) is located along the road in Zion Canyon from the south entrance at Springdale, north to the Temple of Sinawava, and from the canyon junction along the Zion-Mt. Carmel Highway to the East Entrance. This zone provides visitors with highly structured opportunities to enjoy and learn about the park. Both natural processes and the natural landscape are highly modified in this zone.

The **frontcountry low development zone** (797 acres) includes the Kolob Canyons Road, Kolob Terrace Road, Lava Point Campground area, and East Entrance boundary area. Visitor experience in this zone is fairly structured, rural, and oriented around motorized sightseeing on secondary roads, camping, picnicking, and short walks. Natural conditions are unmodified in most of the zone.

Map E: General Management Plan Zones



Map Projection: Tranverse Mercator,
UTM Coordinate System, Zone 12,
Datum: NAD 1983

Map produced by Zion National Park,
Resource Management & Research, GIS Program

N
W E
S

1:210,000

0 Miles 5

The National Park Service does not assume responsibility for information accuracy, precision, or completeness as displayed on this map.

October 2004

The **transition zone** (1,360 acres) includes maintained high-use trails and areas, mainly in Zion Canyon. These areas are day-use only. In this zone, visitors could view or directly access the park's prime resources by non-motorized, well-developed, high-use trails. Use is high near minimal facilities, with the remainder of the zone undisturbed and resources protected.

The **primitive zone** (16,481 acres) includes backcountry trails and popular hiking routes throughout the park. The zone emphasizes a natural landscape, where visitors experience the park on unpaved trails and routes. The zone is a largely undisturbed landscape, with natural processes predominating.

The **pristine zone** (119,447 acres) encompasses remote expanses of land within the park. The zone emphasizes a natural landscape, free of all signs of people, except for faint routes. Natural conditions and process will largely be undisturbed by people.

The **research natural area zone** (9,032 acres) includes nine areas: Parunuweap Canyon, Shunes Creek, Kolob Mesas, Isolated Mesa Tops, Hanging Gardens, Crazy Quilt Mesa, Goose Creek, Slickrock, and Southeast Pinyon Juniper. Emphasis in these areas is on long-term observations to create an ecological benchmark over time. These areas are open for research purposes, but closed to recreational uses. Natural conditions and process are largely undisturbed by people.

The **administrative area zone** (268 acres) includes small areas throughout the park that support park management and administration. These areas are not typically used by visitors. They include employee housing, maintenance facilities, and utility rights-of-way. Natural processes and landscapes can be altered in this zone to support park operations.

Laws, Policies, and Authorities

The following regulations and guidance documents relate directly to the completion of the Fire Management Plan and this Environmental Assessment.

National Environmental Policy Act (NEPA) – The purpose of NEPA is to encourage productive and enjoyable harmony between humans and the environment; to promote efforts that will prevent or eliminate damage to the environment and stimulate the health and welfare of mankind; and to enrich the understanding of the ecological systems and natural resources important to the nation. NEPA requirements are satisfied by successful completion of an environmental assessment or environmental impact statement, in addition to a decision document.

Director's Order-12 (DO-12) – DO-12 is the NPS guidance for Conservation Planning, Environmental Impact Analysis, and Decision Making. DO-12 outlines the guidelines for implementing NEPA according to NPS regulations. DO-12 meets all Council on Environmental Quality (CEQ) regulations for implementing NEPA.

NPS Organic Act 1916 – Congress directed the U.S. Department of the Interior and 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 manner and by such means as will leave them unimpaired for the enjoyment of future generations." (16 United States Code (USC) § 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 USC § 1 a-1)

Director's Order-18 (DO-18) – DO-18 is the NPS guidance for Wildland Fire Management, which states that "every NPS unit with burnable vegetation must have an approved Fire Management Plan (FMP)." DO-18 defines what an approved FMP must include, stressing that "firefighter and public safety is the first priority" and promoting "an interagency approach to managing fires on an ecosystem basis across agency boundaries." Procedures for completion, review, approval, and required contents for FMPs are provided in Reference Manual-18 (RM-18).

Review and Update of the 1995 Federal Wildland Fire Management Policy (2001) – provides guidance and updates for federal fire managers.

Interim Air Quality Policy on Wildland and Prescribed Fires (Environmental Protection Agency) (1998) – provides guidance for mitigating air pollution impacts caused by fires in the wildlands and wildland/urban interface.

In addition to the regulations and orders listed above, other regulations and policies guide the assessment of impacts. These are listed below:

- **NPS Management Policies (2001)** – defines how the NPS will meet its park management responsibilities under the 1916 NPS Organic Act.
- **Clean Air Act and Amendments of 1990** – includes national ambient air quality criteria; states that federal land managers have an affirmative responsibility to protect air quality-related values from adverse impacts.
- **Utah Air Quality Regulations** – provides protection for air quality related values.
- **Utah Water Quality Regulations** – conserves waters of the state to protect, maintain, and improve water quality.
- **Wild and Scenic Rivers Act** – provides for designation and protection of wild, scenic, and recreational rivers.
- **Executive Order 11990** – provides for the protection of wetlands.
- **Clean Water Act** – provides for the protection of waters of the United States.
- **Endangered Species Act (ESA)/Section 7** – provides for the listing and protection of endangered and threatened species and their critical habitat; requires consultation under Section 7 if any listed species may be adversely affected.
- **Wilderness Act of 1964** –states that wilderness areas shall be administered for the use and enjoyment of all people in a manner that will leave them unimpaired for future use and enjoyment as wilderness. Ninety percent of Zion was proposed to Congress as wilderness in 1974.
- **Director's Order-41** – states that proposed wilderness areas are to be managed to preserve their wilderness character and values.
- **National Historic Preservation Act (NHPA)/Section 106** – provides for the identification and protection of historic sites and structures; requires consultation under Section 106 with the Utah State Historic Preservation Officer (SHPO).
- **Archaeological Resource Protection Act** – provides for the protection of archaeological resources on public lands.
- **Executive Order 13007** – provides for protection of Indian sacred sites.
- **NPS Director's Order-28** – defines how the NPS will protect and manage cultural resources on NPS lands in accordance with the NPS Management Policies.

Goals of the Fire Management Plan

The following goals have been identified to guide the fire management program for Zion:

- Ensure that firefighter and public safety is the first priority in every fire management activity and that these activities comply with established fire-safe management practices.

- Prevent and suppress unwanted fires using effective strategies and methods under the decision process of sound risk management.
- Allow for naturally ignited wildland fires to function within their role as an essential ecological process and natural agent of change in maintaining and restoring vegetation communities.
- Use prescribed fire treatments as a naturally functioning process and to achieve vegetation management objectives that support land and resource management plans.
- Document and analyze both short-term and long-term fire effects data in evaluating the effectiveness of fire activities in meeting program objectives and developing scientifically based management decisions.
- Promote understanding and acceptance of the natural role of wildland fire in maintaining and restoring ecosystem function through a proactive public education program.
- Participate, contact, coordinate, and cooperate in interagency programs (federal, tribal, state and local agencies) as part of the essential process in developing agreements, standardizing policies/procedures, and increasing cross-boundary programs.

Desired Future Conditions

In managing and restoring the ecological benefits of fire on the landscape, managers must understand the differences between current conditions and desired future conditions (DFC). Managers must also understand the practices and environmental factors that contributed to the current conditions.

Ayn Shilsky (2003) summarizes the benefits of identifying DFCs:

> *Building a common vision starts with broad goals for a landscape project, but broad goals don't help us determine what to do, where, and when. Desired future conditions include broad goals and spatially explicit assessments of current and reference conditions. Landscape scale descriptions of desired future conditions provide the context for determining integrated finer-scale (i.e., stand) priorities and strategies for fire management, fuel treatment, fire regime restoration, and related resource issues.*

James M. Vose (2000) highlights the importance of an ecosystem perspective:

> *Fire is a potentially powerful tool for achieving desired conditions of forest ecosystems. The departure of current ecosystem conditions from desired ecosystem conditions (defined by structural and functional characteristics) depends on the history of land use and disturbance. The disturbance history also influences the rate of attainment of desired conditions and the magnitude of ecosystem process response. Hence, from an ecosystem perspective, managers must understand the interactions among land use history, current conditions, and desired conditions.*

A number of federal laws and NPS policies and practices helped guide the development of desired conditions for resources potentially affected by fire management activities. It is important to recognize that further work is needed at Zion to better understand the interrelationships within natural systems. As this occurs, desired conditions may be identified as part of adaptive management. This could be accomplished at the landscape or vegetation community scale and could be useful in developing ecological models and refining ecosystem priorities. DFC statements for each affected resource are described below.

Air Quality
- Fire management activities are consistent with the Utah Smoke Management Plan and State Implementation Plan (in development).
- Smoke emissions do not cause unhealthy air quality conditions or exceed National Ambient Air Quality Standards in surrounding areas.
- Fire management activities minimize the aesthetic impacts of smoke on the airshed in Zion.
- Emissions from fires inside the park are managed to minimize impacts beyond park boundaries, through joint planning and implementation with adjacent agencies with jurisdiction.

Vegetation
- Fire processes in fire dependent/adapted vegetation communities are managed to promote healthy and functional ecosystems. Vegetation succession reflects the natural range of variability under conditions that would occur under historical fire regimes.
- Fire is used as a tool to protect and enhance native vegetation communities.
- Fire program operations do not contribute to the spread of invasive weeds in Zion.
- Coordination with Resource Management occurs in developing native seed sources.

Water Quality and Hydrology
- The park adheres to the provisions of the *Zion National Park Water Rights Settlement Agreement* (1996).
- Water quality and flow, from surface and groundwater, reflect the full range of natural conditions that would occur under a natural fire regime. Some aspects of water quality and flow are influenced by fire patterns, such as discharge, sediment transport, nutrient flushing, and flood magnitude.
- Water quality is consistent with state standards developed under the Clean Water Act and is not adversely affected by fire operations.

Natural Soundscapes
- Visitors have opportunities throughout the park to experience natural sounds in an unimpaired condition.
- Disruption for essential fire operations is temporary and limited in scope, time, and area.
- The natural soundscape is conserved during fire management activities.

Wilderness
- Wilderness values are maintained or enhanced through fire management activities.
- Wilderness values (i.e., preservation of natural conditions, outstanding opportunities for solitude, and primitive and unconfined recreational experience preserved and used in an unimpaired condition) are protected while conducting fire management activities. Signs of human activity remain substantially unnoticeable.

Wildlife
- Native wildlife habitat is maintained, restored, or enhanced through fire management practices that are consistent with natural processes.
- Fire is used as a tool to prevent unnatural catastrophic fires, resulting from high fuel loads and denser vegetation that may adversely affect wildlife habitat.

Cultural Resources
- During natural or prescribed ignitions, fire management operations are specifically designed to protect and/or enhance cultural resource integrity, scientific research potential, and interpretive value.

- Fire management staff collaborates with appropriate Resource Management staff to seek information and technical expertise for the purpose of identifying cultural resource preservation and protection needs.

Visitor Experience
- A safe visitor experience is provided throughout fire management activities.
- Information is provided to visitors on the ecological, social, cultural, and aesthetic values of fire.

Park Partners
- Through knowledge and understanding, local and tribal governments, park neighbors, state, interagency cooperators, and the public work collaboratively with the park to implement the fire management program objectives and foster a spirit of cooperation.

Issues and Impact Topics Analyzed in Detail

An issue describes a relationship between an action and an environmental resource. Issues associated with proposed fire management activities were identified through internal and external scoping. Internal scoping included an interdisciplinary team with a member representing each affected division and resource group within the park (refer to the *List of Preparers* in the *Consultation and Coordination* section of this document). External scoping was accomplished through various means, including workshops and an informational newsletter (refer to *Consultation and Coordination* section of this document). Through issue identification, impact topics were also identified. The impact topics are listed below, followed by an issue statement. Each impact topic is described in the *Affected Environment* section and is analyzed in the *Environmental Consequences* section.

Air Quality
- Emissions from fires could reduce air quality below federal, state, or local air quality standards.
- Emissions from fires could affect air quality in adjacent communities.

Threatened or Endangered Animal Species
- Fire could affect species or alter habitat for animal species.

Threatened or Endangered Plant Species
- Fire could affect species or alter habitat for plant species.

Soils
- Fire of varying intensities could alter the physical, chemical, and biological properties of the soil as a result of vegetation removal, consumption of organics, and increased temperatures.
- The lack of fire could alter the physical, chemical, and biological properties of the soil as a result of interrupted nutrients cycling in fire maintained habitat types.

Vegetation
- Fire affects the productivity and composition of vegetation communities.
- As a result of fire exclusion, some habitats are currently characterized by more dense growth. This has also lead to fuel accumulations that have contributed to an ever-increasing large and severe wildland fire problem in these otherwise fire dependent and tolerant vegetation types.
- Plant communities not tolerant or not adapted to fire may be susceptible to detrimental fire effects from increases in invasive non-native plant species that could become established after fire.
- Fire may influence the spread of invasive non-native plant species.

Water Quality and Hydrology
- Bare, burned slopes would be subject to runoff during rainfall events, which could result in sedimentation and nutrient loading to streams. This could degrade the water quality below federal, state, or local water quality standards.

Wetlands
- Fire could affect riparian or wetland vegetation, decreased stream shading, and result in chemical changes for macroinvertebrates.

Natural Soundscapes
- Fire management activities include the use of equipment that would generate noise, which could impact the natural soundscape.
- Fire-related activities and equipment could increase the level of sound in the park and surrounding areas, which could affect the visitor experience.

Wilderness
- Fire management activities could affect wilderness experiences and values.

Wildlife
- Fire could affect habitat for wildlife and fisheries.
- Fire could result in direct mortality of wildlife species.

Cultural Resources
- Fire or fire-related activities could affect cultural resources.

Economic Considerations
- Fire or smoke from fires could alter the socioeconomics of the local area due to changes in visitation.

Park Administration and Visitor Facilities
- Fire or fire-related activities could affect park facilities and infrastructure.

Public Health and Safety
- Fire could be dangerous or present risks to the health, safety, life, or property of firefighters, NPS employees, and the general public.

Visitor Use and Experience
- Fires could prevent visitors from experiencing and enjoying all or part of the park and adjacent areas.

Issues Considered and Dismissed from Further Consideration

The following issues were eliminated from further analysis for the reasons stated below.

Ecologically Critical Areas
Impacts related to proposed wild and scenic rivers are covered under the Water Quality section. No other ecologically critical areas are known in or near the park.

Floodplains
No floodplain functions would be affected by fire or fire management activities proposed in this plan. Functions and values related to wetlands or riparian areas located in or near floodplains are addressed under the wetlands topic.

Prime and Unique Farmlands
No prime and unique farmlands occur in the park or the near vicinity. Two soil types that have been mapped in the park are classified as Statewide Important Farmland by the State of Utah. Cavel fine sandy loam is cultivated on private inholdings in Cave and Lee Valley, and Mespun fine sand is found in sandy valleys and gentle slopes in the southeastern corner of the park.

Energy Requirements/Depletable Resource Requirements and Conservation Potential
None of the alternatives would affect energy depletable resource requirements or conservation potential to the extent that detailed analysis would be required.

Environmental Justice
None of the alternatives would have a disproportionate adverse health or environmental effect on minorities and/or low-income populations and communities.

Indian Trust Resources
Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by the U.S. Department of the Interior agencies be explicitly addressed in environmental documents. No Indian trust resources occur within the park. The lands comprising Zion are not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. Therefore, Indian trust resources were dismissed as an impact topic.

Sustainability and Long-term Management
Aspects of this topic are covered under several others that address long-term management objectives and impacts in relation to fire management activities that would occur under the environmental assessment alternatives.

Sustainability is the result achieved by doing things in ways that do not compromise the environment or its capacity to provide for present and future generations. Sustainable practices minimize the short- and long-term environmental impacts of development and other activities through resource conservation, recycling, waste minimization, and the use of energy-efficient and ecologically responsible materials and techniques.

Water Uses and Water Rights
The use of water in the Virgin River is managed by the State Engineer for Utah under a system of water rights developed by the state. The NPS works within this system when exercising its appropriative rights (those purchased from private owners and tied to a beneficial use) and federal reserved water rights (rights tied to the establishment of Zion by Congress). The use of water from streams, springs, and wells occurs upstream of the park in amounts that do not appreciably alter stream flow in most of the park. The park diverts water for park operations, including irrigation, public water supply, park administration, and fire management. Additionally, the Town of Springdale and Springdale Irrigation Company use a water diversion system from the Virgin River in the park that predates the park.

The recognition and protection of all of the above uses is provided in the *Zion National Park Water Rights Settlement Agreement* (1996) between the United States, the State of Utah, the Washington County Water Conservancy District, and the Kane County Water Conservancy District. This agreement recognizes both appropriative and federal reserved water rights for the park, and the appropriative water rights of other water users in the basin. Since Zion must adhere to the water rights agreement, this issue will not be discussed further in this document.

Evacuation Plans for Areas Adjacent to the Park

Preparing evacuation plans for private lands adjacent to the park was dismissed from further analysis in this document because these areas fall under the jurisdiction of the State of Utah. This responsibility falls under the jurisdiction of the County Sheriffs in coordination with the Utah Division of Forestry, Fire, and State Lands and the county commissioners. The development of an evacuation plan would be coordinated through the county fire wardens and state and county law enforcement agencies. Zion personnel would assist with adjacent area coordination and planning.

ALTERNATIVES

Introduction

This section describes the alternatives analyzed in this document – the No Action and the Proposed Action. The No Action Alternative, Alternative A, represents the existing fire management program. The Proposed Action/Preferred Alternative, Alternative B, describes proposed guidelines for wildland fire suppression, wildland fire use, prescribed fire, mechanical treatments, and herbicide treatments. The following summary tables can be found at the end of the *Alternatives* section:

- Table 7: Comparison of Fire Management Strategies by Alternative
- Table 8: Comparison of the Achievement of Fire Management Goals by Alternative
- Table 9: Impact Summary Table

Alternative A – No Action Alternative (Current Fire Management)

The No Action Alternative is based on the 1992 FMP and the 2002 Wildland-Urban Interface Fuels Management Environmental Assessment/Finding of No Significant Impact (EA/FONSI) (USDI, NPS 2002d).

Current fire management provides that natural fires be allowed to influence existing vegetative ecosystems in Zion when they can be contained within park boundaries, except when such fires threaten public or visitor safety, private lands, or structures. The existing plan also recommends that designated areas in the park, mainly on plateaus, be intentionally burned to maintain or re-establish natural vegetative communities and re-introduce fire into fire dependent park ecosystems.

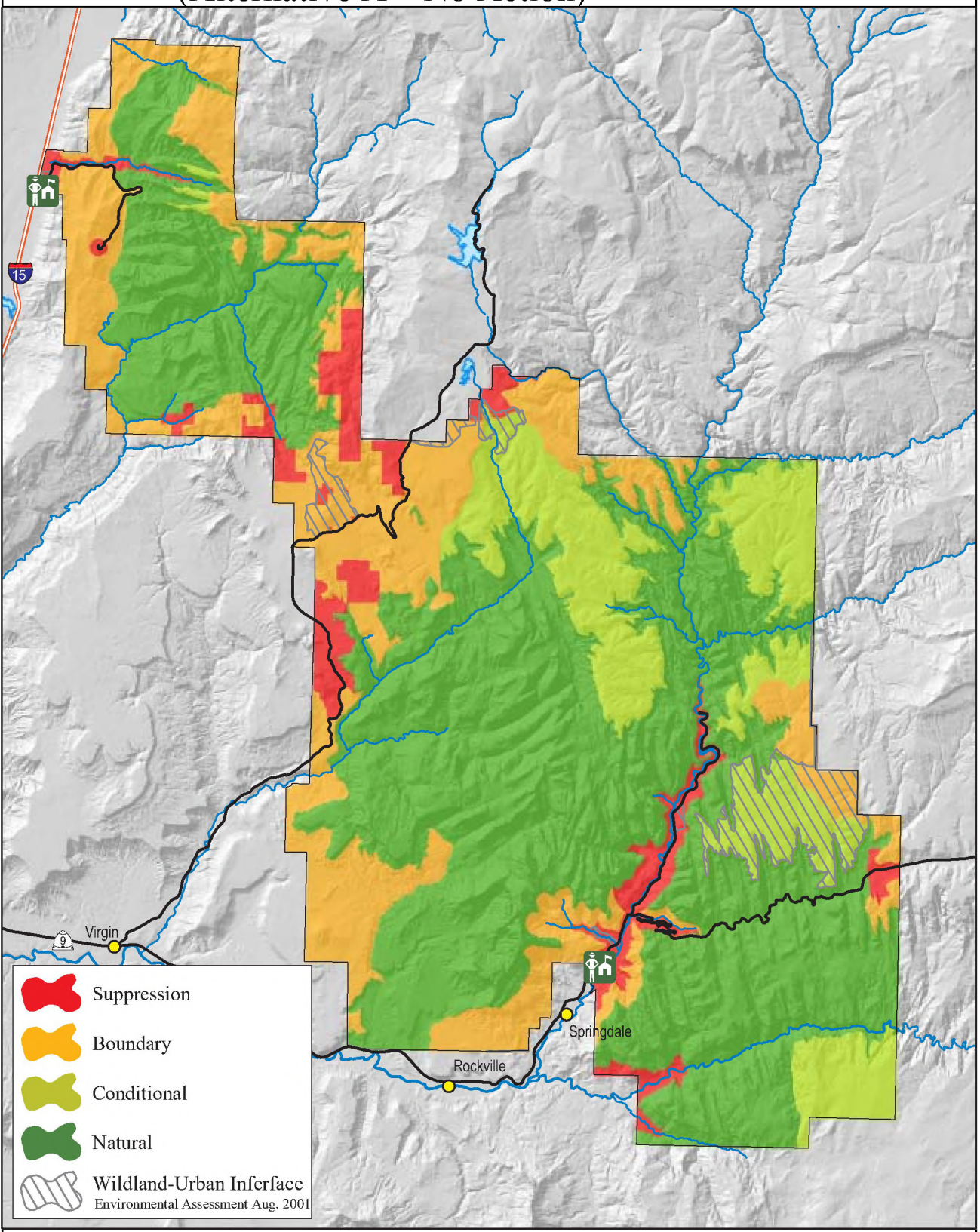
The following apply to all fire operations within Zion unless specifically exempt:

- Use of dozers and other soil-moving heavy equipment require approval by the Superintendent.
- Use of more than two aircraft simultaneously in Zion Canyon would require approval of the Park Aviation Officer. Aircraft are to avoid peregrine falcon nesting sites and areas of high visitor use as much as possible.
- Off-road use of vehicles in the backcountry would be subject to approval by the Chief Park Ranger.
- Clearing vegetation for helispots would be kept to a minimum.
- Suppression actions, such as line construction, would be conducted in such a way as to minimize long-term environmental impacts.
- Sites impacted by fire suppression or by fire would be rehabilitated as necessary, based on an approved course of action for each incident.

As identified in the 1992 FMP, the park is divided into four fire management units (FMUs) based on fuels, topography, and location within the park. The units are Suppression, Boundary, Conditional, and Natural (Refer to Map F). Total acres and percentages listed for each unit in the discussion below reflect the most current geographic information system (GIS) data. Because unit boundaries consist of natural and human-made barriers, they are potential wildland fire containment lines or holding locations for wildland fire use fires. In all units, the appropriate management response would be taken for all wildland fires. Table 5 summarizes the fire management strategies by FMU.

The Wildland-Urban Interface (WUI) areas, analyzed in the 2002 WUI EA/FONSI, overlap FMUs identified in the 1992 FMP (Refer to Map F). The WUI areas are managed under the fire management prescriptions for the units they overlap, although the WUI areas have also been identified for specific fuel reduction actions.

Map F: Current Fire Management Units
(Alternative A – No Action)



Map Projection: Tranverse Mercator,
UTM Coordinate System, Zone 12,
Datum: NAD 1983

Map produced by Zion National Park,
Resource Management & Research, GIS Program

N
W E
S

1:210,000

0 Miles 5

The National Park Service does not assume responsibility for information accuracy, precision, or completeness as displayed on this map.

October 2004

The FMUs and WUI actions are summarized below.

Suppression Fire Management Unit (9,430 acres – 6 percent)

In the Suppression FMU, aggressive attack would be made to suppress wildland fires at minimum size using the appropriate response. Prescribed fires would be allowed to reduce hazardous fuels and for resource management purposes, but wildland fire use fires are not allowed at any time. The Suppression FMU encompasses areas of high visitor use, private property, and public facilities. The FMU is not continuous and includes the following sub-units:

- Unit S-1 East Entrance
- Unit S-2 Zion Canyon
- Unit S-3 Mouth of Parunuweap
- Unit S-4 Lava Point
- Unit S-5 Kolob Overlook
- Unit S-6 Kolob Administrative Site
- Unit S-7 Kolob Inholdings
- Unit S-8 Cave Valley

Boundary Fire Management Unit (32,991 acres – 22 percent)

In the Boundary FMU, wildland fires would be suppressed using the appropriate response in the boundary FMU. Prescribed fires would be allowed as in the Suppression FMU. Wildland fire use fires would be allowed when fire danger is low or moderate. A wildland fire use fire starting in a Boundary unit would be managed to prevent spread out of that unit; holding actions along a border would be included in the fire situation analysis and approved as part of the wildland fire use fire. If a wildland fire use fire enters a Boundary unit from another fire unit, it must meet the more restrictive prescription criteria to continue to be managed as a wildland fire use fire. A single fire would have only one designation regardless of the number of FMUs in which it is burning. Only two wildland fire use fires would be allowed in the Boundary FMU at any time, with active monitoring. This strategy is designed to encourage the benefits of wildland fire use fires at minimal risk to adjoining properties. The Boundary FMU includes areas along the park boundary and around private inholdings. Boundary FMU sub-units include:

- Unit B-1 East Boundary
- Unit B-2 East of Checkerboard Mesa
- Unit B-3 East Slopes of Lower Zion Canyon
- Unit B-4 Rockville Bench
- Unit B-5 Crater Hill and Kolob Terrace Road
- Unit B-6 Reserved for future use
- Unit B-7 Lower Lee Valley
- Unit B-8 Upper Lee Valley
- Unit B-9 Hop Valley Trailhead
- Unit B-10 Firepit Knoll
- Unit B-11 Pocket Mesa
- Unit B-12 Bauer Fingers
- Unit B-13 Bullpen Mountain
- Unit B-14 Buck Pasture Plateau
- Unit B-15 Horse Ranch Mountain
- Unit B-16 North Boundary of Kolob
- Unit B-17 Hurricane Cliffs
- Unit B-18 Current Creek
- Unit B-19 Goose Creek Knoll

- Unit B-20 Goose and Kolob Creeks

Conditional Fire Management Unit (20,801 acres – 14 percent)

Contain and/or confine strategies would usually be the preferred options for suppression of wildland fires in the Conditional FMU. Prescribed fires would be permitted to restore natural processes to ecosystems, reduce hazard fuel accumulations, and for resource management purposes. Wildland fire use fires would be permitted under less restrictive constraints than in the Boundary FMU, but more restrictive than for the Natural FMU. Wildland fire use fires would be allowed except during very high or extreme fire danger. If a wildland fire use fire enters a Conditional unit from another FMU, it must meet the unit criteria to continue to be managed as a wildland fire use fire. Conditional FMU sub-units include:

- Unit C-1 North of Orderville Canyon
- Unit C-2 South of Orderville Canyon
- Unit C-3 Eastside
- Unit C-4 South of Parunuweap
- Unit C-5 Wildcat Canyon
- Unit C-6-10 Horse Pasture Plateau
- Unit C-11 Kolob Fingers

Natural Fire Management Unit (84,802 acres – 57 percent)

The Natural FMU is designed to allow fire to assume a natural role in ecosystem dynamics to the greatest extent possible. Therefore, wildland fires in the unit would most likely be suppressed using a confine strategy, approved in an *Escaped Fire Situation Analysis*. Naturally ignited wildland fires would be allowed to reach significant size in the four large, irregularly shaped areas that make up this FMU. Prescribed fires would be allowed, but their use is expected to be limited. In units N-1, N-2, and N-3, wildland fire use fires would be allowed in all but extreme fire danger conditions. Unit N-4 consists of isolated mountain tops, mesas, and other features accessible only by helicopter or technical rock climbing. Natural FMU sub-units include:

- Unit N-1 Zion Backcountry – east of North Fork
- Unit N-2 Zion Backcountry – west of North Fork
- Unit N-3 Kolob Backcountry
- Unit N-4 Mountain Tops and Mesas

Wildland-Urban Interface Areas

The wildland-urban interface (WUI) project would reduce wildland fire fuel buildups in nine treatment areas. The treatment methods that would be used are grouped into two broad categories: area-wide prescription burns with thinned buffer areas, and slash pile burns with thinned buffer areas. The treatment units are located in developed areas within the park, in areas where the park is bordered by residential areas, and along corridors of ongoing urban and residential construction.

Fuel reduction at these sites would help implement the park's FMP by creating a buffer strip with low fuel availability between the park's interior and adjacent private properties, reducing the probability that an ignition would burn uncontrolled across the park boundary. In addition, these treated areas could reduce the intensity of a fire that originated outside the park and migrated across the park boundary, and could increase firefighters' ability to gain control of a wildland fire.

A description of each project area is provided below.

- The Blue Creek area is adjacent to the Lava Point lookout and Lava Point ranger station. Its eastern boundary ties into the West Rim trailhead. The Pocket Mesa unit listed below is located to the west of this unit (project completed).
- The Clear Trap area is located along the eastern park boundary, north of State Route 9.
- The Firepit Knoll area contains an NPS backcountry cabin and borders six private-land inholdings.
- The Kolob Headquarters and Visitors Center area includes the Kolob headquarters, visitor center, maintenance buildings, and staff housing (project completed).
- The Zion Lodge area includes a hotel and cabins that are historic NPS buildings. This historic district is listed on the National Register of Historic Places (project completed).
- The Oak Creek area contains staff housing. The buildings in this area are included within a historic district that is listed on the National Register of Historic Places (project completed).
- Pocket Mesa is located in the north-central part of the park, with its western border along the Kolob Terrace Road. Private land occurs on the northern border.
- The Ponderosa Fence area is north of the Clear Trap project area along the eastern boundary of the park. It connects with the Orderville Canyon rim on the north and into the Clear Trap project on the south at the Stave Spring trailhead (project partially completed).
- Rockville Bench is located at the south end of the park. This area is bordered by private property to the south (project completed).

This page intentionally left blank

Table 5: Alternative A – Summary of Fire Management Strategies by Unit					
FIRE MANAGEMENT UNITS	**Wildland Fire Suppression Strategy**	**Wildland Fire Use For Resource Benefit Strategy**	**Prescribed Fire Strategy**	**Mechanical Strategy**	**Herbicide Strategy**
SUPPRESSION Areas of high use, private property, and public facilities; these discontinuous units give protection for Zion Canyon and inholdings along the Kolob Terrace Road.	•**Allowed:** would use aggressive attack to suppress wildland fires at minimum size using the appropriate suppression response.	•**Not allowed** at any time.	•**Allowed:** would be used to reduce hazardous fuels and for resource management purposes.	•**Not allowed** •**Exception:** would be allowed in identified wildland urban interface areas (2002 Zion Wildland Urban Interface Fuels Management EA/FONSI).	•**Not allowed**
BOUNDARY Areas along the park boundary or bordering inholdings.	•**Allowed:** fire would be suppressed using the appropriate suppression response.	•**Allowed:** would be managed to prevent spread out of that single unit; holding actions along a border would be included in the fire situation analysis and approved as part of the prescribed natural fire. • If a prescribed natural fire enters a Boundary FMU from another FMU, it must meet the more restrictive prescription criteria to continue to be managed as a prescribed natural fire.	•**Allowed:** would be used as in the Suppression FMU. •Allowed in conditions of low and moderate fire danger.	•**Not allowed** •**Exception:** would be allowed in identified wildland urban interface areas (2002 Zion Wildland Urban Interface Fuels Management EA/FONSI).	•**Not allowed**

Table 5: Alternative A – Summary of Fire Management Strategies by Unit					
FIRE MANAGEMENT UNITS	**Wildland Fire Suppression Strategy**	**Wildland Fire Use For Resource Benefit Strategy**	**Prescribed Fire Strategy**	**Mechanical Strategy**	**Herbicide Strategy**
CONDITIONAL Areas within the interior of the park or along the park boundary adjacent to other federal or state managed lands.	•**Allowed:** contain or confine would usually be the preferred options for appropriate suppression.	•**Allowed:** under less restrictive constraints than in the Boundary FMU, more restrictive than for the Natural FMU. •Allowed except during very high and extreme fire danger. •If a prescribed natural fire enters a Conditional FMU from another fire unit, it must meet the unit criteria to continue to be managed as a prescribed natural fire.	•**Allowed:** would be used to restore natural processes to ecosystems, reduce hazard fuel accumulations, and for resource management purposes.	•**Not allowed** •**Exception:** would be allowed in identified wildland urban interface areas (2002 Zion Wildland Urban Interface Fuels Management EA/FONSI).	•**Not allowed**
NATURAL Areas within the interior of the park or along the park boundary adjacent to other federal or state managed lands.	•**Allowed:** most likely would be suppressed using a confine strategy, approved in an *Escaped Fire Situation Analysis*.	•**Allowed:** fires could reach a large size. The fires would be designed to allow fire to assume a natural role in ecosystem dynamics to the greatest extent possible.	•**Allowed:** use is expected to be limited in some areas. •Allowed in all but extreme fire danger conditions.	•**Not allowed**	•**Not allowed**

Alternative B – Proposed Action/Preferred Alternative

The proposed action would allow for implementation of the full range of fire management strategies. Wildland fire strategies would include suppression and wildland fire use for resource benefit. Fuels management strategies would include prescribed fire, mechanical, and herbicide treatments. The main focus of these activities and treatments, as currently emphasized by national policy, is public and firefighter safety, communities identified as at risk from wildland fires (wildland urban interface), historic fire regime, current condition class, and collaboration with other agencies and stakeholders. Table 6 summarizes the fire management strategies that would be allowed under Alternative B by FMU. Map G shows the proposed FMUs. Zion would use an adaptive management approach to fuels management, which means that the fuels management program would continue to be evaluated over time, based on results of the current program, with adjustments made where appropriate. Appendix C outlines the five-year fuel treatment plan, which is based on current fuel conditions and national emphasis as of March 2004.

The proposed fire management plan would be implemented over the next 10 years to:

- continue to allow a return of fire as a natural process in fire-adapted ecosystems;
- recognize fire as an essential process and agent of natural change;
- increase the emphasis on wildland urban interface and interagency coordination; and
- continue to monitor fire activities and fire effects to determine if goals are being met.

The following constraints would apply to all wildland fire operations unless specifically exempt:

- Use of dozers and heavy ground disturbing equipment must be approved by the Superintendent.
- Engines and vehicles would not be permitted to operate off-road in recommended wilderness areas.
- Use of air tankers in sensitive (but not developed) areas must be approved by the Superintendent, except to prevent imminent loss of structures.
- Helispots must conform to the Interagency Helicopter Operations Guide, which requires minimal disturbances for landings.
- Use of two or more aircraft in Zion Canyon on the same project must be approved by the Park Aviation Officer.

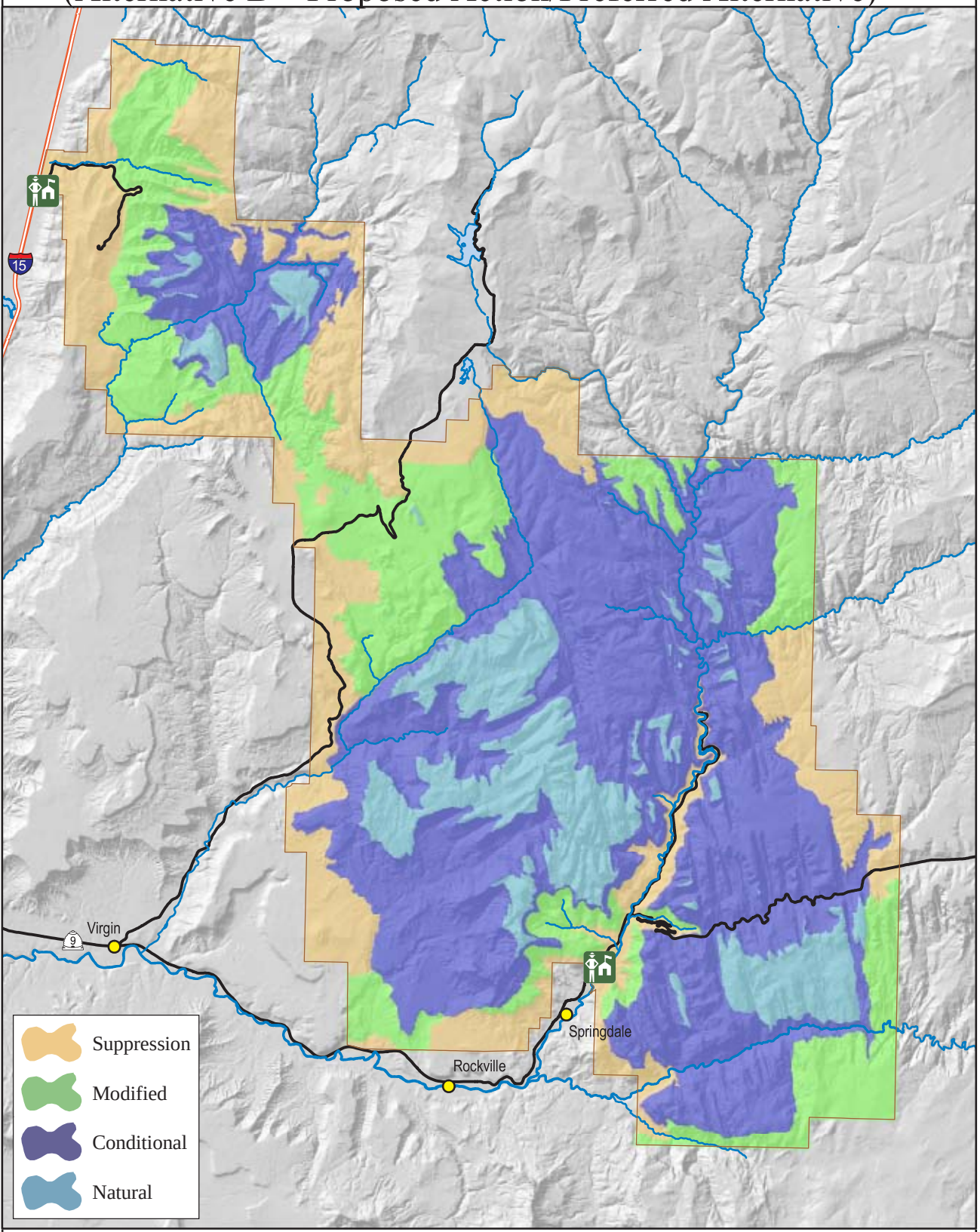
The following actions would apply to all FMUs and strategies:

- Firefighter and public safety would be the first priority in every fire management activity.
- Minimum Impact Suppression Techniques (MIST) would be used throughout the park (Refer to Appendix D).
- Minimum tool assessment and park management approval would be needed for activities using mechanized equipment in recommended and/or other proposed wilderness.
- All fire management actions would take into consideration and mitigate any potential increase or spread of non-native plant species (i.e., all equipment would be decontaminated and power washed prior to entering park lands).

Fire Management Strategies

The fire management strategies that would be implemented under this alternative include wildland fire suppression, wildland fire use, prescribed fire, mechanical treatments, and herbicide treatments. These strategies are described below.

Map G: Proposed Fire Management Units
(Alternative B – Proposed Action/Preferred Alternative)



Map Projection: Tranverse Mercator,
UTM Coordinate System, Zone 12,
Datum: NAD 1983

Map produced by Zion National Park,
Resource Management & Research, GIS Program

N
W E
S

1:210,000

0 Miles 5

The National Park Service does not assume responsibility for information accuracy, precision, or completeness as displayed on this map.

October 2004

Wildland Fire Suppression Strategy
All wildland fire suppression activities would provide for firefighter and public safety as the highest consideration. Suppression activities would strive to minimize the potential damage to natural and cultural resources, and would take into consideration economic expenditures, firefighting resources, and other fire priorities (local, regional, and national preparedness).

The concept of appropriate management response is integral to fire management policy. Management responses are programmed to accept resource management needs and constraints, reflect a commitment to safety and cost effectiveness, and accomplish desired objectives while maintaining the versatility to varying fire intensities as conditions change. The appropriate management response would be used to curtail the spread of fire and eliminate or reduce all fire threats to identified resources. Appropriate management response could include "confine and contain" actions or aggressive suppression actions.

A confine/contain action could be used to create a fuel break around a fire, allowing the fire to burn to the fuel break. The break could include natural barriers or could consist of manually and/or mechanically constructed lines. Active firefighting actions may not be implemented in areas where natural fuel breaks exist. Using natural fuel breaks could increase fire size, but could provide for firefighter safety and reduce disturbances on the land from ground firefighting actions caused by fire line construction. This strategy could allow managers to focus firefighting activities on an area of the fire where life, property, and natural or cultural resources are threatened, while allowing other areas to burn out naturally.

More aggressive suppression strategies could be used when critical resources are threatened. An example of an aggressive suppression strategy would be to attack along the fires edge with fire engines, hand lines, aerial resources, and in some cases dozers or heavy ground disturbing equipment used to create fire lines.

Aircraft resources could be used for all fire management activities, including reconnaissance, detection, ignition, personnel and logistical transportation, and fire control missions, such as retardant/bucket drops. The purpose of this action would be to transport personnel and equipment, as well as facilitate implementation of fire management operations. Use of aircraft would be managed to meet all safety, wilderness, and soundscape objectives.

During suppression operations, holding actions could be implemented to prohibit the fire from crossing containment boundaries, whether natural or human-made. Holding actions could include the construction of fire lines, reduction of excessive fuel concentrations, reduction of vertical fuel continuity, creation of fuel breaks, or utilization of natural barriers. These operations or actions could be implemented around critical or sensitive sites or resources. Wildland fires will follow the Wildland Fire Situation Analysis (WFSA) process in managing suppression actions.

Wildland Fire Use Strategy

Naturally ignited wildland fires could be managed (wildland fire use) to accomplish specific resource management goals and/or objectives in pre-defined fire management zones within the park. This strategy would be implemented within the park along some park boundaries with neighboring federal or state lands, or where human or resource values at risk are minimal. Many of the suppression actions previously described could be used to manage wildland fire use fires.

Wildland fire use fires could be used to meet similar objectives as prescribed fires. The fire could be managed to reduce hazardous fuels, reintroduce fire into fire dependent plant communities, restore natural ecosystems that have been modified by prolonged fire exclusion, restore vegetative composition, research fire effects, and maintain natural systems.

Wildland fire use fires would follow the Wildland Fire Implementation Plan (WFIP) created for each fire, describing maximum manageable areas, available resources, monitoring plans, and identified threatened resources, along with establishing trigger points for implementing suppression actions if needed.

Prescribed Fire Strategy

Prescribed fires are defined as any fire that is ignited by management to meet specific objectives. Prescribed fires could be used anywhere within the park to:

- reduce hazardous fuels;
- reintroduce fire into fire dependent vegetation communities;
- restore natural ecosystems that have been modified by prolonged fire exclusion;
- remove/reduce non-native plant species;
- improve vegetative compositions to natural levels (example enhance habitat and forage quality for wildlife);
- reduce debris or dispose of mechanically treated fuels; and
- conduct maintenance burning where natural fires could not be managed.

Prescribed fire activities would use prescriptions identified in a plan that describe conditions (wind speed and direction, relative humidity, dew point, temperature, rate of fire spread, and flame length) under which the fire could be ignited. These measurable conditions would be monitored to ensure that prescribed conditions were met. Each prescribed fire treatment would follow a written plan that would be approved by the Superintendent before implementation.

Prescribed fire treatment boundaries would be drawn in areas where fires could be contained or controlled. When identifying these boundaries the park would try to maximize the use of natural fuel breaks or areas of reduced fuels/vegetation densities. These boundaries could be augmented by mechanical treatments to create perimeter lines. Each prescribed fire would be managed and monitored by qualified personnel prior to and during all operations until the fire is declared extinguished.

It is anticipated that through the reintroduction of fire using prescribed fire applications, some natural fire ignitions could be managed to maintain natural areas, thereby reducing the need for additional prescribed fire treatments. Some areas would continue to be maintained using prescribed fire due to the proximity of values at risk.

Seeding areas burned by prescribed fire would be considered, particularly where the probability of achieving resource objectives is enhanced. This strategy could be used to increase native species, such as grasses, to effectively compete with non-native plants. In most cases, areas would not be seeded due to the risk of introducing non-native species.

Prescribed fires could be used to research or investigate the effects of these treatments. Treatments could be studied to determine if sustainable ecological conditions could be met or replicated. Long-term data collection could be associated with these treatments.

Many of the suppression resources and strategies that were described previously under the *Wildland Fire Suppression Strategy* could be used to manage prescribed fire (e.g., aviation use for ignition, management or control, or retardant use).

Mechanical Strategy

Mechanical equipment could be used to reduce fuels as a stand-alone fuels treatment method, or in combination with other treatments in preparation for a prescribed fire project, as part of a restoration

project, or during wildland fire operations, including both suppression and "fire use" actions. Types of mechanical treatments could include thinning, vegetation removal, chipping, and girdling by any of the methods described below.

Mechanical methods could include:

- **non-mechanized handheld tools** (e.g., shovels, saws, axes, pulaskis, rakes, and tools currently and historically used in suppression activities);
- **mechanized handheld tools** (e.g., chainsaws, brush cutters, weed trimmers, leaf blowers, grass trimmers/cutters, clippers, and mowers); or
- **mechanized equipment** (**wheeled or tracked)** (e.g., light-on-the-land forestry equipment that includes all-terrain-vehicles with attachments, such as mowers, chippers and small tractors pulling/attaching similar equipment, as well as aerial equipment, such as airplanes and helicopters. Larger equipment with large, low impact tires, bull-hogs, front–end loaders, masticators, GyroTracs, feller-bunchers, chippers, or other similar equipment that is designed for large fuel removal, dispersal, elimination, or reduction).

Mechanized wheeled or track equipment could be used in wildland urban interface areas, along park boundaries, along inholding boundaries, in developed areas within the park, and for resource restoration projects (e.g., Virgin River restoration, aspen restoration and regeneration, or other fire dependant vegetation restoration projects); such use would be consistent with minimum tool procedures for recommended wilderness areas and soundscape objectives.

Heavy equipment that uses large tires or large tracks in order to result in less ground disturbances would be the first choices for use. The use of any heavy ground disturbing equipment would need to be approved by the Superintendent. Projects that require equipment that may have ground disturbing effects would be planned and implemented during times when the ground may be covered with snow or frozen, in order to reduce impacts to soil and vegetation.

This list of mechanized equipment is not inclusive. Each year, modern technology produces new equipment that can do more with lower impacts. These technological advances may be explored or utilized during the life of this plan to implement fire management activities. Cable systems and aerial removal with helicopters is a common commercial tree/fuel removal technique that could be used. The equipment selected for projects would be subject to a minimum tool selection process to meet the wilderness, soundscape, and General Management Plan objectives.

Herbicide Strategy

Herbicide treatments would be used on a limited basis and only after all other options have been considered, mainly in areas where non-native plants dominate the area, such as the annual non-native grasses currently found in Zion Canyon or other canyons/drainages and minor areas along the park boundary that coincide with wildland urban interface areas.

Post-emergent herbicides could be used to reduce and remove existing, non-native species. Pre-emergent herbicides could be used to prevent non-native plant seeds from germinating. These applications could be applied as the sole treatment, with no additional management strategies, or could be used in combination with other management treatments.

Herbicides could be used in conjunction with prescribed fire treatments to reduce or remove non-native plants. This strategy could be used either prior to or following plant germination. This technique may enable native perennial grasses, forbs, and shrubs to grow or re-sprout without competition from fast growing non-native plants.

Applications of herbicides could also be used to reduce native plant populations in areas where other treatment methods may be impractical or inefficient. Examples of these areas include wildland urban interface areas or areas around other high value resources.

Herbicides would be applied only by certified applicators, using both stump sprays and foliage treatments. Manufacturer specifications and Environmental Protection Agency (EPA) regulations for herbicide use would be followed.

Aerial applications of herbicides could also be used where large invasive patches occur or where other application treatments are impractical or inefficient. Aerial applications could be used in wildland urban interface areas where the desired effect is to reduce and remove brush and tree species. The removal of these fuels could reduce the intensity of fires in these treated areas. Any aerial use of herbicides would require additional NEPA compliance.

Fire Management Units

Under the proposed action the park would be divided into the following four FMUs: Suppression, Modified, Conditional, and Natural. The FMUs were drawn on the basis of geologic features, topography, vegetation, access, and other considerations that include development and private land areas within and along the park boundary (Refer to Map G). Table 6 summarizes management strategies by FMU.

Often the goal of a particular fire management activity is to change the composition of vegetation communities to allow fire to become a functioning component of natural ecosystem processes. When this goal is achieved, unit boundaries could be adjusted to allow for more natural processes to occur. This adjustment would be made through the annual fire management planning amendments. If inholdings or adjacent lands are acquired, adjustments through the annual fire planning amendment process would be made to unit boundaries.

Wildland fire use fires crossing from one unit to another would be evaluated in the WFIP. In some cases, natural or defensible boundaries to confine and/or contain a fire might be in the neighboring unit. The daily validation of the WFIP would guide managers in evaluating boundaries, resource objectives, and public safety.

Suppression Fire Management Unit (33,236 acres – 22 percent)

The focus of the Suppression FMU would be to minimize the threat of fire to life and property and to ensure that ecosystems are managed to meet NPS objectives. Wildland fire is considered an unacceptable risk in these areas due to the threats to firefighter and public safety, private property, and park infrastructure. An effort would be made to reduce hazardous fuels in this unit to provide for firefighter and public safety, and to reduce risks to park and private structures. Methods to achieve this goal could include prescribed fire, use of mechanical methods, or herbicide treatments.

The Suppression FMU encompasses developed areas within the park, park lands around private inholdings, and lands along portions of the park boundary. Since much of this unit borders private and other state/federal lands, partnerships and interagency coordination would be fostered with neighbors along the park boundary. These partnerships could allow for cross-boundary fuel treatments. This approach could also enhance ecosystem health across the landscape and reduce visible differences on each side of the boundary, as well as reduce fire threat.

In areas with a wildland urban interface, adjacent private lands, private inholdings, or where resource values may be at risk, a treated fuels buffer could be considered if the area contains continuous fuels. The buffer area could reduce the intensity of a fire that originates in or outside the park and migrates across the park boundary. This buffered area could increase firefighter's ability to gain control of a wildland fire.

Management Strategies

Wildland fires would follow the WFSA planning process in managing suppression actions. Within this unit all wildland fires would be **suppressed** using the appropriate management response. A confine and contain action could be used if risks to life and safety of suppression personnel prohibit direct attack. Otherwise, direct attack would be used to suppress wildland fires at a minimum size.

All available firefighting tools and resources could be used, including non-mechanized and mechanized handheld tools, fire engines, fire retardants, and aviation resources. Motorized and mechanized wheeled or track equipment could be used off-road with approval from the Superintendent.

Wildland fire use for resource benefit would not be allowed in this unit. Fire could be allowed to enter the Suppression FMU from an adjoining unit, where the appropriate response would be used to reach containment and control of the fire.

Prescribed fire treatments would be allowed as part of a hazardous fuel reduction project to protect private property and park infrastructure. Treatments could also be implemented in fire dependent ecosystems within this unit or as part of a research project. Prescribed fire would be used to reduce dead and down fuel loading and decrease live fuel densities. These prescribed fires would be implemented under an approved prescribed fire burn plan, which would be developed for each treatment. The most up-to-date scientific information would be used in planning and implementing prescribed fire treatments.

Firefighting tools and resources that could be used include non-mechanized and mechanized handheld tools, fire engines, aviation resources, and other typical fire management tools. Other equipment could be considered on a case-by-case basis in order to protect life, property, or resources with approval from the Superintendent.

Mechanical methods would be primarily implemented near developed areas and along the park boundary to protect private property and park infrastructure. Mechanical methods could also be used in vegetation restoration projects or to protect cultural or natural resources. These methods would be used to thin or reduce fuels and vegetation in and around these resources. Due to the annual nature of some non-native vegetation types within the park, some areas may need to be treated each year to maintain safe conditions.

Tools and resources that could be used include non-mechanized and mechanized handheld tools, light forestry equipment, and aviation resources. Mechanized wheeled or track equipment could be used off-road with approval from the Superintendent.

Herbicide treatments would be used where non-native plant species have replaced or have invaded natural vegetation. The focus would be near developed areas or where there are resource management concerns. Developed areas would include all areas containing structures or areas defined as wildland urban interface. Resource management concerns could include riparian areas infested with tamarisk or uplands infested with thistle, knapweed, or similar aggressive non-native species. Some resource treatments could be completed to protect native plant populations, cultural resources, or degraded wildlife habitats.

Herbicide treatments could also be used to reduce fuel density and continuity where mechanical or other methods may not be feasible due to increased costs, increased risk to nearby resources, and time constraints related to urgent factors, like weather changes or significant increases in development.

Non-native plant infestations change the vegetation composition, which could allow fires to enter areas that are not fire adapted or could increase the duration, frequency, or intensity of fire in vegetation communities. Due to the annual nature of some of the non-native vegetation types within the park, some areas may need to be treated each year to maintain a condition of reduced fuels. These treatments would work toward the overall decrease of the invading species, increasing ecosystem health and improving the safety (from wildland fire) in the area to visitors and employees.

Tools and resources that could be used include non-mechanized and mechanized handheld tools. Light-on-the-land forestry equipment could be used off-road with approval from the Superintendent. These equipment types could include all-terrain-vehicles with attachments, such as boom sprayers, large balloon tractor tires, or lightweight, low impact tracked machines.

Modified Fire Management Unit (30,689 acres – 21 percent)

In the Modified FMU managers would look for opportunities to allow fire to maintain its natural role while protecting life, property, and resources. In order to accomplish this, managers would evaluate fuel types and available fuels in relation to fire spread within natural and human-made fire barriers. An effort would be made to reduce hazard fuels in this unit to provide for firefighter and public safety. Methods to achieve this goal could include prescribed fire activities, mechanical methods, or herbicide treatments.

The Modified FMU includes portions of the park boundary abutting lands managed by other government agencies and some interior areas of the park. Since much of this unit borders private and other federal lands, partnerships and interagency coordination would be fostered with these neighbors. Partnerships could allow for cross-boundary fuel treatments. This approach could also enhance ecosystem health across the landscape and reduce the visible differences on each side of the boundary.

Management Strategies

All wildland fires would be assessed to determine if a wildland fire use strategy would be appropriate. Under this approach a WFIP would be completed. If it was determined that wildland fire was not appropriate, the fire would be **suppressed**. A confine and contain action would be the preferred or primary approach. Direct attack tactics could be implemented to reach containment and control of the fire. A WFSA would be completed for these suppression actions.

All available firefighting tools and resources could be used, including non-mechanized and mechanized handheld tools, fire engines, fire retardant, and aviation resources. Mechanized wheeled or track equipment could be used off-road with approval from the Superintendent.

Wildland fire use for resource benefit would be considered in lieu of suppression for lightning-ignitions under favorable weather conditions. An example of a favorable weather condition would be lower temperatures and wind speeds with increasing humidity. Location, weather trends, and the time of season for each wildland fire would be considered. All actions would take place under a WFIP which would evaluate threats to public and firefighter health and safety, natural and cultural resources, fire behavior (flame length, rate of spread), fuel conditions (moisture content of vegetation), expected size and duration of the fire, fuel continuity (sparse vs. dense vegetation), the availability of resources to manage the fire, and wildland fire activity levels locally, regionally, and nationally.

Firefighting tools and resources that could be used include non-mechanized and mechanized handheld tools, fire engines, fire retardant, and aviation resources. Mechanized wheeled or track equipment could be used off-road with approval from the Superintendent.

Prescribed fire would be allowed, as part of a hazardous fuel reduction project, to protect cultural and natural resources, as a restoration treatment in fire dependent ecosystems, or as part of a research project. As in the Suppression FMU, the most current scientific information would be used in planning and implementing prescribed fire treatments.

Firefighting tools and resources that could be used include non-mechanized and mechanized handheld tools, fire engines, aviation resources, and other typical fire management tools. Other equipment could be considered on a case-by-case basis with approval from the Superintendent in order to protect life, property, or resources.

Mechanical methods would be primarily used near the park boundary to protect neighboring lands, as part of a restoration project, or to protect natural or cultural resources. These methods could be used to thin or reduce hazard fuels or non-native vegetation. Some areas may need to be treated yearly because of the type of vegetation being treated.

Tools and resources that could be used include non-mechanized and mechanized handheld tools, light forestry equipment, and aviation resources. Mechanized wheeled or track equipment could be used off-road with approval by the Superintendent.

Herbicide treatments could be used to reduce non-native plants near park boundaries or other areas of non-native plant infestations. Herbicide treatments could also be used to reduce fuel density and continuity where mechanical methods may not be feasible, or to protect important cultural or natural resources.

Non-native plant infestations change vegetation composition, which could allow fire into non-adapted fire systems. This could increase fire duration, frequency, and intensity in these areas. Due to the annual nature of some non-native vegetation types within the park, these areas may need treatment each year to maintain safe conditions.

Tools and resources that could be used include non-mechanized and mechanized handheld tools. Light-on-the-land forestry equipment (all-terrain-vehicle boom sprayers) could be used off-road with approval by the Superintendent.

Conditional Fire Management Unit (66,713 acres – 45 percent)

Wildland fire would be managed to perform its natural role in ecosystem maintenance within the Conditional FMU. The primary goal of managing lightning-ignited fires within this unit is to allow fires to function as a natural process in promoting ecosystem health. The park's fire management overhead team would manage these fires using the WFIP to determine the go/no-go decision for each fire.

Fire growth in these areas could be limited by natural barriers and would be managed under less restrictive prescriptive elements or indices than the Modified FMU. The risk to life and property from fire would be low to moderate within this unit. Work would be done to reduce hazard fuels in this unit to provide for firefighter and public safety. All strategies (including prescribed fire activities, mechanical methods, or herbicide treatments) could occur within this unit but would be limited due to the goal of managing these areas in a pristine or primitive state. The Conditional FMU would be bordered by the

Suppression and Modified FMUs and surround most of the Natural FMU. This FMU would encompass most of the interior of the park.

Management Strategies

All wildland fires would be assessed to determine if a wildland fire use strategy would be appropriate. A WFIP would be completed under this approach. If wildland fire use is not appropriate, the fire would be **suppressed**. A confine or contain action would be the primary method used in trying to reach containment and control of the fire. The secondary method used would be direct attack actions to contain and control the fire. A WFSA would be completed for the firefighting approach.

Tools and resources that could be used include non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. Mechanized wheeled or track equipment could be used off-road with approval by the Superintendent.

Wildland fire use for resource benefit would be the preferred strategy for this FMU. This strategy would be considered for all lightning-ignitions under favorable weather conditions. An example of favorable weather conditions could include moderate temperatures and wind speeds with higher humidity. Location, weather trends, and the time of season for each wildland fire ignition would be considered. All actions would take place under a WFIP which would evaluate threats to public and firefighter health and safety, natural and cultural resources, fire behavior (flame length, rate of spread), fuel condition (moisture content of vegetation), expected size and duration of the fire, fuel continuity (sparse vs. dense vegetation), availability of resources to manage the fire, and wildland fire activity levels locally, regionally, and nationally.

Firefighting tools and resources that could be used include non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. Mechanized wheeled or track equipment could be used off-road with approval by the Superintendent.

Prescribed fire would be allowed as part of a hazardous fuel reduction project, as a restoration treatment in fire dependent ecosystems, or as part of a research project. Prescribed fire would be used to protect important natural and cultural resources. As in the Suppression FMU, the most current scientific information would be used in planning and implementing prescribed fire treatments.

Tools and resources that could be used include non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. Other equipment could be considered on a case-by-case basis with approval from the Superintendent in order to protect life, property, or resources.

Mechanical methods would be used as part of a restoration project or to protect natural and cultural resources. These methods could be used to thin or reduce hazard fuels. Some areas may need to be treated yearly because of the type of vegetation being treated.

Tools and resources that could be used include non-mechanized and mechanized handheld tools, aviation resources, and light forestry equipment. Mechanized wheeled or track equipment could be used off-road with approval from the Superintendent.

Herbicide treatments would be used on a limited basis and only after all other options have been considered (such as mechanically girdling trees to reduce crown biomass) and only as part of a non-native plant control project or to protect important natural and cultural resources. Non-native plant infestations change vegetation compositions, which could allow fire into a non-adapted fire system. This could increase fire duration, frequency, and intensity in these areas. Due to the annual nature of many of the

non-native vegetation types within the park, some areas may need treatment each year to maintain safe conditions.

Hand tool application of herbicides would be used. Mechanized handheld tools could also be used. Any non-handheld mechanized herbicide dispersal would need the approval of the Superintendent.

Natural Fire Management Unit (17,386 acres – 12 percent)

Wildland fire would be allowed to continue its natural role in ecosystem maintenance in the Natural FMU. Most of the lightning-ignited fires would be monitored and managed for resource benefit within this FMU. The park's fire management overhead team would manage these fires using the WFIP to determine the go-no-go decision for each fire.

The Natural FMU encompasses many of the isolated mesa tops, some slickrock areas, and some Research Natural Areas where risk to life and property from wildland fire is low. Unwanted human-caused fires would be suppressed in this FMU. Most of this FMU consists of remote or isolated areas where human-caused fires would be an unlikely event.

Fire growth in these areas would be limited by natural barriers and would be managed under the least restrictive prescriptive elements or indices as compared to the other units. All strategies (including prescribed fire activities, mechanical methods, or herbicide treatments) could be used within this FMU, but would be greatly limited due to the goal of managing these areas in a pristine or primitive state to the fullest extent possible.

Management Strategies

All wildland fires would be assessed to determine if a wildland fire use strategy would be appropriate. If wildland fire use is not appropriate, the fire would be **suppressed**. A confine or contain action would be the primary method used in trying to reach containment and control of the fire. In most cases the fire would be allowed to enter another FMU or more accessible area where direct attack tactics would be used, incorporating the minimum amount of suppression resources.

Tools and resources that could be used include non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. Other equipment could be considered on a case-by-case basis with approval from the Superintendent in order to protect life, property, or resources.

Wildland fire use for resource benefit would be the preferred strategy for this FMU and would be used to maintain and conserve natural processes. It could be used when air temperatures and wind speeds are high with lower humidity. Location, weather trends, and the time of season for each wildland fire ignition would be considered. All actions would take place under a WFIP that would evaluate threats to public and firefighter health and safety, natural and cultural resources, fire behavior (flame length, rate of spread), fuel conditions (moisture content of vegetation), expected size and duration of the fire, fuel continuity (sparse vs. dense vegetation), availability of resources to manage the fire, and wildland fire activity levels locally, regionally, and nationally.

Firefighting tools and resources that could be used include non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. Other equipment could be considered on a case-by-case basis with approval from the Superintendent in order to protect life, property, or resources.

Prescribed fire would be used as part of a hazardous fuel reduction project to protect important cultural or natural resources, as a restoration treatment in fire dependent ecosystems, or as part of a research project.

Tools and resources that could be used include non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. Other equipment could be considered on a case-by-case basis with approval from the Superintendent in order to protect life, property, or resources.

Mechanical methods would be very limited. They would be used only as part of a restoration project, to protect important natural and cultural resources, or as part of a research project.

Tools and resources that could be used include non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. Other equipment could be considered on a case-by-case basis with approval from the Superintendent in order to protect life, property, or resources.

Herbicide treatments would be extremely limited and used only after all other options have been considered, and used only to control non-native plants, reduce hazardous fuels, protect important cultural or natural resources, or as part of a research project.

Hand tool application of herbicides would be used. Mechanized handheld tools could also be used. Any mechanized herbicide dispersal would need the approval of the Superintendent.

Table 6: Alternative B – Summary of Fire Management Strategies by FMU					
FIRE MANAGEMENT UNITS	**Wildland Fire Suppression Strategy**	**Wildland Fire Use For Resource Benefit Strategy**	**Prescribed Fire Strategy**	**Mechanical Strategy**	**Herbicide Strategy**
SUPPRESSION **FMU includes** most of the park boundary adjacent to private lands and sections within the park that are adjacent to wildland/urban interface and private inholdings. **Focus of FMU** is to minimize the threat of fire to life, property, and resources; also to ensure ecosystems are managed to meet NPS objectives.	· **Allowed:** Fires would be suppressed using confine, contain or direct attack tactics using all available firefighting resources; WFSA process would be used. · **Tools that would be allowed**: non-mechanized and mechanized handheld tools, fire engines, fire retardant, and aviation resources. · **Tools that could be allowed with Superintendent approval:** mechanized wheeled or tracked equipment off-road.	· **Not allowed** · **Exception:** Fire could be allowed to enter this unit from adjacent units and would be managed to reach containment and control. · **Tools that would be allowed**: non-mechanized and mechanized handheld tools, fire engines, aviation resources, and other typical fire management tools. · **Tools that could be allowed with Superintendent approval:** mechanized wheeled or tracked equipment off-road**.**	· **Allowed:** Treatments would be used as part of a hazardous fuel reduction project to protect private property and park infrastructure, a restoration treatment in fire dependant ecosystems, or as part of a research project studying fire. · **Tools that would be allowed**: non-mechanized and mechanized handheld tools, fire engines, aviation resources, and other typical fire management tools. · **Tools that could be allowed with Superintendent approval:** on a case-by-case basis other equipment could be considered to protect life, property, or resources.	· **Allowed:** Treatments would be used primarily near developed areas and the park boundary to protect private property and park infrastructure. A secondary approach would be to use this method in vegetation restoration projects or to protect cultural or natural resources. · **Tools that would be allowed**: non-mechanized and mechanized handheld tools, light forestry equipment, and aviation resources. · **Tools that could be allowed with Superintendent approval:** mechanized wheeled or tracked equipment off-road.	· **Allowed:** Use would primarily be to reduce non-native plants near developed areas or areas of resource management concern. A secondary approach could be to use this strategy to reduce fuel density and continuity where mechanical methods may not be feasible. · **Tools that would be allowed**: non-mechanized and mechanized handheld tools. · **Tools that could be allowed with Superintendent approval:** light-on-the-land forestry equipment off-road.

Table 6: Alternative B – Summary of Fire Management Strategies by FMU					
FIRE MANAGEMENT UNITS	**Wildland Fire Suppression Strategy**	**Wildland Fire Use For Resource Benefit Strategy**	**Prescribed Fire Strategy**	**Mechanical Strategy**	**Herbicide Strategy**
MODIFIED **FMU includes** portions of the boundary where the majority of adjacent land is managed by other government agencies. The unit also includes interior portions of the park. **Focus of FMU** is to look for opportunities to allow fire to maintain its natural role, while protecting life, property, and resources.	· **Allowed:** All natural ignitions would be considered for resource benefit using a WFIP. Primary strategy would be to use confine and contain tactics or direct attack tactics. · **Tools that would be allowed:** non-mechanized and mechanized handheld tools, fire engines, fire retardant, and aviation resources. · **Tools that could be allowed with Superintendent approval:** mechanized wheeled or tracked equipment off road.	· **Allowed:** This action would be considered in lieu of suppression for lightning-ignitions when temperatures and wind speeds are low and humidity is increasing[1]. The primary purpose of this strategy is to maintain and conserve natural processes. All actions would occur under a WFIP. · **Tools that would be allowed:** non-mechanized and mechanized handheld tools, fire engines, fire retardant, and aviation resources. · **Tools that could be allowed with Superintendent approval:** mechanized wheeled or tracked equipment off road**.**	· **Allowed:** Treatments would be used as part of a hazardous fuel reduction project to protect cultural or natural resources, a treatment in fire dependant ecosystems as part of a restoration project, or as part of a research project. · **Tools that would be allowed**: non-mechanized and mechanized handheld tools, fire engines, aviation resources, and other typical fire management tools. · **Tools that could be allowed with Superintendent approval:** on a case-by-case basis other equipment could be considered to protect life, property, or resources.	· **Allowed:** Treatments would be used primarily near the park boundary, as part of a restoration project, or to protect cultural or natural resources. · **Tools that would be allowed**: non-mechanized and mechanized handheld tools, light forestry equipment, and aviation resources. · **Tools that could be allowed with Superintendent approval:** mechanized wheeled or tracked equipment off-road.	· **Allowed:** Use would primarily be to reduce non-native plants near boundary areas or other areas of non-native plant infestations. A secondary approach could use herbicides to reduce fuel density and continuity where mechanical methods may not be feasible, or to protect important cultural or natural resources. · **Tools that would be allowed**: non-mechanized and mechanized handheld tools. · **Tools that could be allowed with Superintendent approval:** light-on-the-land forestry equipment off-road.

Table 6: Alternative B – Summary of Fire Management Strategies by FMU					
FIRE MANAGEMENT UNITS	**Wildland Fire Suppression Strategy**	**Wildland Fire Use For Resource Benefit Strategy**	**Prescribed Fire Strategy**	**Mechanical Strategy**	**Herbicide Strategy**
CONDITIONAL **FMU includes** areas within the interior of the park. **Focus of FMU** is to allow fire to function naturally, while protecting life, property, and resources.	· **Allowed:** All lightning-ignitions would be considered for resource benefit using a WFIP. If a fire cannot be managed for these benefits, suppression would be used to contain the fire. · **Tools that would be allowed include:** non-mechanized and mechanized handheld tools, fire retardant, and aviation resources · **Tools that could be allowed with Superintendent approval:** mechanized wheeled or tracked equipment off-road.	· **Allowed:** The preferred strategy. Would be used when temperatures and wind speeds are moderate with higher humidity[1]. All actions would occur under a WFIP. · **Tools that would be allowed include:** non-mechanized and mechanized handheld tools, fire retardant, and aviation resources**.** · **Tools that could be allowed with Superintendent approval:** mechanized wheeled or tracked equipment off-road.	· **Allowed:** Treatments would be used as part of a hazardous fuel reduction project to protect important cultural or natural resources, a restoration treatment in fire dependant ecosystems, or as part of a research project. · **Tools that would be allowed include:** non-mechanized and mechanized handheld tools, fire retardant, aviation resources. · **Tools that could be allowed with Superintendent approval:** on a case-by-case basis other equipment could be considered to protect life, property, or resources.	· **Allowed:** Treatments would be used as part of a restoration project or to protect cultural or natural resources. · **Tools that would be allowed include**: non-mechanized and mechanized handheld tools, fire engines, and aviation resources · **Tools that could be allowed with Superintendent approval:** mechanized wheeled or track equipment off-road.	· **Allowed:** Use would be limited and applied only as part of a non-native plant control project or to protect important cultural or natural resources. · **Tools that would be allowed**: hand tool applications, including mechanized handtools. · **Tools that could be allowed with Superintendent approval:** any non-handheld mechanized tool or dispersal method.

Table 6: Alternative B – Summary of Fire Management Strategies by FMU					
FIRE MANAGEMENT UNITS	**Wildland Fire Suppression Strategy**	**Wildland Fire Use For Resource Benefit Strategy**	**Prescribed Fire Strategy**	**Mechanical Strategy**	**Herbicide Strategy**
NATURAL **FMU includes** isolated mesa tops, some slickrock areas, and the majority of Research Natural Areas. **Focus of FMU** is to allow fires' natural role to function within the ecosystem.	· **Allowed:** All lightning-ignitions would be considered for resource benefit using a WFIP. If a fire cannot be managed for these benefits, suppression would be used to contain the fire using the minimum amount of suppression resources. · **Tools that would be allowed include:** non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. · **Tools that could be allowed with Superintendent approval:** on a case-by-case basis other equipment could be considered to protect life, property, or resources.	· **Allowed:** The preferred strategy. Could be used with higher air temperatures and wind speeds and lower humidity[1]. All actions would occur under a WFIP. · **Tools that would be allowed include:** non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. · **Tools that could be allowed with Superintendent approval:** on a case-by-case basis other equipment could be considered to protect life, property, or resources.	· **Allowed:** Treatments would be used as part of a hazardous fuel reduction project to protect important cultural or natural resources, a treatment in fire dependant ecosystems as part of a restoration project, or as part of a research project. · **Tools that would be allowed include:** non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. · **Tools that could be allowed with Superintendent approval:** on a case-by-case basis other equipment could be considered to protect life, property, or resources.	· **Allowed:** Treatments would be very limited and would be used only as part of a restoration project, to protect important cultural or natural resources, or as part of a research project. · **Tools that would be allowed include:** non-mechanized and mechanized handheld tools, fire retardant, and aviation resources. · **Tools that could be allowed with Superintendent approval:** on a case-by-case basis other equipment could be considered to protect life, property, or resources.	· **Allowed:** Use would be extremely limited and only applied to control non-native plants, to protect important cultural or natural resources, or as part of a research project. · **Tools that would be allowed**: hand tool applications, including mechanized. · **Tools that could be allowed with Superintendent approval:** any non-handheld mechanized tool or dispersal method.
Common to all units and strategies	(1) Firefighter and public safety would be the first priority in every fire management activity. (2) Minimum Impact Suppression Techniques would be used throughout the park. (3) Minimum tool assessment and park management approval would be needed for activities using motorized equipment in recommended or proposed wilderness. (4) All treatment actions would take into consideration and mitigate any potential increase or spread of invasive non-native plants (including decontaminating and power washing equipment if exposed to invasive non-native plant species before entering park lands).				

[1] Refer to the fire use description in the *Proposed Action* for more details on the weather indices, prescription parameters, and decision criteria related to this process. Refer to the *Glossary* for definitions of terminology.

Mitigation Measures

Mitigation is defined in the Code of Federal Regulations (40 Code of Federal Regulations (CFR) 1508.20) as:

- Avoiding the impact altogether by not taking a certain action or parts of an action.
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- Compensating for the impact by replacing or providing substitute resources or environments.

Mitigation Measures for Alternative A – No Action Alternative (Current Fire Management)

Air Quality/Smoke Management

- Comply with the *EPA Interim Air Quality Policy on Wildland and Prescribed Fires,* and *Utah State Implementation Plan* and *Enhanced Smoke Management Plan*.
- Evaluate smoke dispersion using modeling, collection of field level observations, and other techniques as part of planning for and managing each fire.
- Use long-range planning to minimize the cumulative effects of smoke on visibility (e.g., over many years, several low intensity fires can emit less smoke overall than one or two high intensity fires).
- Train fire management staff on current best management practices and techniques for minimizing and/or managing smoke emissions.
- Use scheduling, fuel conditions, ignition patterns, and other fire management tools to enhance smoke dispersal.
- Monitor smoke conditions during all fires.
- Alert nearby communities to upcoming management fires and the current status of all fires.

Soils

- Minimize soil disturbances during fire operations, especially if creating fire lines.

Vegetation (including threatened, endangered, and sensitive species; and weeds)

- Consult threatened and endangered species recovery plans, specialists, and scientific literature when designing fire management objectives and prescriptions.
- Comply with the Endangered Species Act.
- Use Burn Area Emergency Rehabilitation (BAER) techniques when needed.
- Train fire staff to identify invasive weeds and weed prevention best management practices.

Water Quality and Hydrology

- Avoid contaminating surface water with fire retardant by directing retardant drops away from perennial streams and springs whenever possible.
- When collecting and transporting water for fire operations, select water sources to minimize the risk of capturing exotic organisms (fish, plants, or invertebrates) or disease (whirling disease) that might be introduced into the Virgin River or its tributaries. The first choice for drafting water would be to use park irrigation ditches that pull water from the Virgin River or its tributaries.
- Avoid fuel spills in or near water sources by refueling equipment at least 50 feet from standing water or stream courses, and use a containment pan.
- Install portable toilet facilities at spike camps for type 1-3 incidents. Consider bag disposal where access for portable toilets is not practical or for type 4-5 incidents.
- Keep water use for fire management operations within park water rights; this would be a relatively minor portion of overall use. Document the amount of water used, and compare it to overall

administrative use. Water Rights are respected as defined in the Zion National Park Water Rights Settlement Agreement.
- Evaluate post-fire erosion and vegetation recovery potential to determine if secondary treatments for watershed protection are necessary.

Wetlands
- Retain sufficient vegetative cover within 0.25 mile of perennial streams to minimize sediment, ash, and woody debris transport in streams.

Natural Soundscapes
- Minimize noise associated with fire management activities by limiting the scope and area, and by timing the use of mechanical equipment to meet essential fire management requirements.
- Minimize impacts of fire management aircraft overflights, consistent with natural soundscape objectives.

Wilderness
- Use the minimum tool process for all non-emergency fire management activities within the recommended wilderness.
- Minimize use of motorized equipment or mechanical means of transport (refer Appendix D). In some situations equipment/mechanical activities would only be allowed with the approval of the Superintendent.
- Ensure aviation use is consistent with the Minimum Impact Suppression Techniques (refer to Appendix D).
- Restrict the number of flights to the minimum necessary consistent with the threats or risks to soundscapes, resources, public health, safety, and property.
- Use planned flight routes to avoid recommended wilderness or noise sensitive areas/resources.
- Use ground access for fire management activities whenever possible.

Wildlife (including threatened, endangered, and sensitive species)
- Comply with the Endangered Species Act.
- Limit disturbances that come from above nest sites/eyries for Mexican spotted owl, peregrine falcon, and goshawks (March-September).
- Restrict low altitude use of fire aircraft to not lower than 500 feet within a 105-meter radius of known Mexican spotted owl territories during the breeding season (March 1-August 31), unless risk of human injury or death is imminent (Delaney et al. 1999).
- Use threatened and endangered species recovery plans and scientific literature to design fire objectives and prescriptions. Follow recovery plan recommendations for use of fire aircraft (horizontal and vertical distances).
- Avoid burning and suppress fires in desert tortoise habitat. Desert tortoise habitat (blackbrush-dominated desert) rarely burns; desert tortoises are not adapted to fire. Many of the native desert plants that tortoises feed on have not evolved with fire and are replaced by invasive non-native plants when burned.
- Ensure burn plans and prescriptions consider multi-species habitat needs and spatial variables (home range, mobility). If possible, attempt to maximize habitat patchiness instead of a single-intensity burn.
- Leave snags and cavity-bearing trees in place when reducing fuel loads. These resources may be removed when there is potential for fire to spread to park developed areas or private property, or for human safety and resource concerns (i.e., archaeological sites).

- Avoid removing all coarse woody debris that is important to small mammal species. Fuels greater than or equal to 3 inches in diameter would be removed within 20 feet of values at risk. Fuels greater than or equal to 6-inches in diameter would be removed within 50 feet of values at risk.

Cultural Resources
- Conduct intensive archaeological survey in areas identified for planned treatments.
- Remove or thin vegetation around historic structures and/or significant landscape features (sawmill remnants, telephone poles, etc.), and archaeological sites to reduce fire intensity.
- Avoid surface disturbing suppression techniques within cultural resource boundaries (sites, historic districts, landscapes, structures) unless techniques are warranted for resource protection and supervised by a cultural resource advisor.
- Carry, rather than drag, mechanically removed fuels to reduce surface disturbance within cultural resource boundaries. Remove slash from thinning areas to designated locations for off-site disposal.
- Shield sites and structures (rock art, dendroglyphs, structures, etc.) from flame contact; limit exposure to fog spray, foam, backpack pumps, low pressure sprinklers, and damaging high temperatures or lengthy heavy smoke exposures by using fire shelters or wrap. Reduce fuel loads as mentioned above or apply other techniques.
- Avoid using retardant, other additives, or high pressure streams directly on rock art. These techniques could be applied as an indirect protective measure.
- Avoid direct applications of bucket or air tanker drops. Water drops could be applied as an indirect protective measure for cultural resources.

Visitor Use and Experience/Public Health and Safety/Economic Considerations
- Inform visitors of planned and current area closures due to fire management activities through press releases, notices at trailhead and visitor facility bulletin boards, backcountry permitting, the park website, and other means as necessary.
- To protect visitors, temporarily close trails and/or roads, use cautionary signing on trials and/or roads, and close facilities if warranted.
- Plan prescribed fires when visitor use is low and smoke is unlikely to impact high visitor use areas.
- Minimize use of aircraft, or route aircraft around high-use or sensitive areas.

Mitigation Measures for Alternative B – Proposed Action/Preferred Alternative

Mitigation under Alternative B would include **all those for Alternative A, plus the following additional mitigating measures:**

Air Quality/Smoke Management
- Burn in seasons characterized by meteorological conditions that allow for efficient smoke dispersion.
- Use ignition techniques, such as aerial ignition by helicopter, to produce safe, high intensity fires with short duration impacts. High intensity burning causes the rapid rise of smoke into the atmosphere where it more quickly disperses.
- Ignite burns under good to excellent ventilation conditions and suspend operations under poor smoke dispersion conditions.
- Consider smoke impacts and residual smoke on activities conducted by local communities and land users.
- Burn only those wildland fuels essential to meet management objectives.
- Minimize duff consumption, smoldering, and large fuel consumption through monitoring fuel moisture considerations.
- Burn fuels such as piles when other burns are not feasible, such as when snow or rain is present.

- Protect public health, public safety, and visibility by spreading smoke impacts over a broader time period and geographic area.
- Burn during optimum weather periods to prevent trapping smoke in inversions or diurnal wind flow patterns.
- Consolidate burning material to enhance fuel consumption and to minimize smoke production.
- Implement maintenance burning in a periodic rotation mimicking natural fire cycles to reduce excessive wildland fuel accumulations and subsequent excessive smoke production through smoldering or wildland fires.
- Manage smoke impacts by 1) minimizing smoke impacts to roads, highways, and airports to the amounts, frequencies, and durations consistent with any guidance provided by highway and airport personnel; and 2) minimizing smoke impacts to Class I areas, or areas that are non-attainment for particulates, and/or carbon monoxide non-attainment areas, or other smoke sensitive receptors.
- Alert visitors, residents, and local communities of planned prescribed fires.

Vegetation (including threatened, endangered, and sensitive species; and weeds)
- In most cases, avoid seeding to reduce erosion because catastrophic erosion events following a fire are typically not a substantial problem in this area. The risk of non-native seeds being introduced generally outweighs the risk of accelerated erosion.
- If restoration requires seeding, use native plant seed only and, to the extent possible, acquire seed from the local area.
- When fire operations occur in weed infested areas, stage a power wash station at or near incident and/or helibases, if possible. Wash all vehicles and equipment upon arrival from and departure to each incident.
- Inspect clothing for weed seeds if foot travel has occurred in infested area. Clean/remove seed to the extent possible upon arrival and departure to the park.

Water Quality and Hydrology
- Coordinate with the Utah Division of Wildlife Resources to identify emergency water sources around the park that are free of noxious exotic species.
- Follow all label restrictions for use of herbicides in or near aquatic systems.

Natural Soundscapes
- Use tools that reduce noise impacts, such as non-motorized tools and equipment, and use quiet technology for motorized equipment.
- Explore options for use of quiet aircraft technologies.

Wilderness
- Use restoration techniques that mimic natural fire regime occurrences.

Wildlife (including threatened, endangered, and sensitive species)
- Re-sample Virgin spinedace populations when flush events following a fire occur. Record observations of increased levels of woody debris and ash entering hydrologic systems to understand the process for future fires and as part of a BAER.
- Peregrine Fund personnel (who are contracted by US Fish and Wildlife Service (USFWS) to monitor the condor) would be contacted prior to prescribed burn to determine where condors are roosting and frequenting. Roost areas and individual condors would be actively avoided. If fire staff cannot avoid condors, condors would be hazed to leave the area by authorized Peregrine Fund personnel.

Visitor Use and Experience/Public Health and Safety/Economic Considerations

- Limit the number, area, and duration of trail and areas closures in order to maintain opportunities for solitude and primitive, unconfined recreation.
- Develop interpretive themes and educational messages that inform the public (both inside and outside the park) about the aesthetic and ecological value of fire. Implement using a variety of media and methods, such as park publications, the park website, visitor contact stations, roving contacts, interpretive programs, community outreach, and school programs.

Environmentally Preferred Alternative

As stated in Section 2.7.D of *Director's Order #12 and Handbook* (USDI, NPS, 2001a), the environmentally preferred alternative is the alternative that will promote the national environmental policy expressed in the National Environmental Policy Act (Sec. 101 (b)). This includes alternatives that:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Ensure for all Americans 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 and 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.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Simply put, "this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (Question 6a in Council on Environmental Quality 1981). In the NPS, the No Action Alternative may also be considered in identifying the environmentally preferred alternative.

Alternative A represents the current fire management practices at Zion. While both prescribed fire and limited mechanical vegetation clearing for fuels management are part of the current management situation, Alternative A relies more heavily on prescribed burning alone and is less aggressive in the use of integrated fuels treatments.

Therefore Alternative A could allow for the continued buildup of woody fuels, with an accompanying risk of uncontrolled wildland fire. This type of event would result in adverse affects to many of the park's resources.

The Proposed Action/Preferred Alternative, Alternative B, would reduce the risk of uncontrolled wildland fire by reducing the buildup of woody fuels in treatment areas through more aggressive and strategic use of mechanical fuels reduction and prescribed fire. The Preferred Alternative as compared to current management/No Action Alternative would:

- Provide an environment with low fuel loads that would mimic the appearance and behavior of natural, fire-adapted communities and enhance the protection of resources for succeeding generations.
- Reduce the risk to human health and safety and other undesirable consequences of wildland fire.
- Improve the safety, healthfulness, and esthetics of the surroundings.
- Provide better protection of historic, cultural, and natural resources.

Therefore, Alternative B, the Proposed Action/Preferred Alternative, also would be the environmentally preferred alternative.

Alternatives Considered but Dismissed From Further Analysis

The following alternatives were identified by the public through scoping (for a complete description of scoping, refer to the *Consultation and Coordination* section of this document). For the reasons stated below they will not be further analyzed in this document.

Using Domestic Livestock to Reduce Fuels

The use of domestic livestock to reduce fuels was dismissed from further analysis for the following reasons:

- The regulations outlined in *36 CFR – Parks, Forests, and Public Property* include the rules the parks must follow in managing lands within the National Park System. The regulations do not allow the parks to graze livestock for any purpose, unless the use is specifically identified by the park in 36 CFR or in the park's enabling legislation (refer to Appendix B).
    - *36 CFR Part 2 – Resource Protection, Public Use, and Recreation §2.60 Livestock and Agriculture* states that: *(a) the running-at-large, herding, driving across, allowing on, pasturing or grazing of livestock of any kind in a park area or the use of a park area for agricultural purposes is prohibited, except: (1) As specifically authorized by Federal statutory law; or (2) As required under a reservation of use rights arising from acquisition of a tract of land; or (3) As designated, when conducted as a necessary and integral part of a recreational activity or required in order to maintain a historic scene.* Zion National Park does not meet any of the exceptions.

Full Suppression of all Wildland Fires

An alternative to fully suppress all wildland fire within the park was dismissed from further analysis because it would be inconsistent with the *2001 Federal Wildland Fire Management Policy* and the Zion GMP.

- 2001 Federal Wildland Fire Management Policy
    - *Ecosystem Sustainability: The full range of fire management activities will be used to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social components.*
    - *Use of Wildland Fire: Wildland fire will be used to protect, maintain, and enhance resources and, as nearly as possible, be allowed to function in its natural ecological role. Use of fire will be based on approved Fire Management Plans and will follow specific prescriptions contained in operational plans.*
    - *The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.*
- Zion GMP 2001
    - *To reinstitute the natural fire process, both management-ignited and naturally ignited fires are occurring under closely managed conditions.*
    - *Park staff will apply ecological principles to ensure that natural resources are maintained and not impaired. They will manage fire to maintain and/or restore ecosystem integrity.*

Selling Trees for Firewood or Lumber

The legislation designating or adding lands to Zion (refer to Appendix B) does not specifically allow for the selling of trees for firewood or lumber, so selling trees is subject to the rules published in *36 CFR – Parks, Forests, and Public Property*.

- *Part 2 – Resource Protection, Public Use, and Recreation §2.1 Preservation of natural, cultural, and archaeological resources (c)* which states *(3) The following are prohibited: (v) Sale or commercial use of natural products.*

There is nothing in existing federal regulation that would allow Zion to sell wood for commercial purposes; therefore, this alternative will not be analyzed further in this document.

Federal agencies have been directed to reduce risk to firefighters, communities, and municipal watersheds, and to restore health to forests and rangelands. *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment, 10-year Comprehensive Strategy* was completed in August 2001, along with a memorandum from the Secretary of the Department of the Interior, January 2003, that outlines strategies and hazardous fuel treatment priorities for federal agencies. One of the national fuel treatment priorities states "Contracted fuels treatment work should receive preference over work performed by the federal workforce. Our goal for FY 2004 is to contract out 50 percent of the allocated funding. Whenever possible, projects should use third-party contracting that support rural community stability. This is consistent with Congressional direction and Goal Four of the *10-year Implementation Plan*."

Hazardous fuel projects in Zion have been small in scale. Historically the discarded vegetation has been piled and burned on site. Larger-scale projects proposed in the five-year plan would focus on service contracts that could potentially use the vegetation. These projects have clear objectives to reduce hazard fuel risk around wildland urban interface. In some instances, removal of fuels from the site may be necessary as part of the hazard fuel project. Options for removal of this vegetation would continue to be explored under existing laws and regulations. However, these contracted hazardous fuel reduction projects would not be construed as or based on sale of trees for commercial purposes as prohibited by law.

Table 7: Comparison of Fire Management Strategies by Alternative

Fire Management Strategy	Alternative A: No Action	Alternative B: Proposed Action/Preferred Alternative
Suppression	**Allowed** in all fire management units.	**Allowed** in all fire management units, utilizing the best combination of confine, contain, direct attack tactics or the appropriate management response to improve safety and reduce impacts.
Wildland Fire Use for Resource Benefit	**Allowed** in all fire management units **except** the Suppression Unit.	**Allowed** to start in all FMUs **except** the Suppression FMU. Fire could enter the Suppression FMU when better containment or control boundaries are defined within the Suppression FMU to improve safety and reduce impacts.
Prescribed Fire	**Allowed** in all fire management units.	**Allowed** in all fire management units.

Table 7: Comparison of Fire Management Strategies by Alternative		
Fire Management Strategy	**Alternative A: No Action**	**Alternative B: Proposed Action/Preferred Alternative**
Mechanical Treatments	**Limited allowance** around administrative and boundary locations. Allowed in identified wildland urban interface areas due to additional NEPA compliance (2002 Zion Wildland Urban Interface Fuels Management EA/FONSI)	**Allowed** in all fire management units, with emphasis on boundary and wildland urban interface protection. New direction and importance on identifying fire/vegetation condition class and highlighting needs for modification/restoration of stand structure as a stand-alone treatment or in conjunction with prescribed fire or other treatments.
Herbicide Treatments	**Not allowed.** Exotics or non-native vegetation types were not as prevalent.	**Allowed** in all fire management units. This strategy would only be used after other treatments have been considered. Focus would be primarily on exotic plants in wildland urban interface areas, or newly/recently treated or disturbed areas to reduce exotics from becoming established. Limited use could be considered in other areas or units to improve safety and protect resources.

Table 8: Comparison of the Achievement of Fire Management Goals by Alternative		
Fire Management Plan Goal	**Alternative A: No Action**	**Alternative B: Proposed Action/Preferred Alternative**
Ensure that firefighter and public safety is the first priority in every fire management activity and that these activities comply with established fire-safe management practices.	Meets the goal to some degree, but does not address wildland urban interface issues in all areas.	Meets the goal by adding additional management strategies that could decrease fire intensities, which could increase firefighter and public safety.
Prevent and suppress unwanted fires using effective strategies and methods under the decision process of sound risk management.	Meets the goal.	Meets the goal by improving fire management guidance and better defines fire management units with pre-determined suppression responses.
Allow for naturally ignited wildland fires to function within their role as an essential ecological process and natural agent of change in maintaining and restoring vegetation communities.	Meets the goal.	Meets the goal by identifying more realistic boundaries to manage fire within the park, such as use of natural fuel breaks to confine fire within and between units.
Use prescribed fire treatments as a naturally functioning process and to achieve vegetation management objectives that support land and resource management plans.	Partially meets the goal, but does not specifically address vegetation management objectives.	Meets the goal by linking fire management treatments with vegetation management objectives outlined in the general management plan. The proposed fire plan also addresses how fire management actions tie to general management plan desired conditions for all ecosystem components in the park.
Document and analyze both short-term and long-term fire effects data in evaluating the effectiveness of fire activities in meeting program objectives and developing scientifically-based management decisions.	Meets the goal.	Meets the goal by continuing to monitor the effectiveness of fire treatments and provides more flexibility to adapt to new technologies and management practices.
Promote understanding and acceptance of the natural role of wildland fire in maintaining and restoring ecosystem functions through a proactive public education program.	Partially meets the goal; the existing fire plan does not specifically outline strategies for public fire education.	Meets the goal by identifying information, education, and prevention methods and programs to better facilitate outreach.

Table 8: Comparison of the Achievement of Fire Management Goals by Alternative		
Fire Management Plan Goal	**Alternative A: No Action**	**Alternative B: Proposed Action/Preferred Alternative**
Participate, contact, coordinate, and cooperate in interagency programs (federal, tribal, state and local agencies) as part of the essential process in developing agreements, standardizing policies/procedures, and increasing cross-boundary programs.	Meets the goal, but is limited in scope.	Meets the goal by providing enhanced flexibility and management support with cooperating neighboring land owners and agencies. Provides for better cross-boundary management and decision making.

Table 9: Comparative Summary of Impacts		
Impact Topic	**Alternative A, No Action**	**Alternative B, Proposed Action/Preferred Alternative**
Air Quality	Alternative A would result in short-term, minor to moderate adverse impacts to air quality because more intense fires would be expected to occur during the prime summer burning period and use of prescribed fire would result in emissions of air pollutants, smoke, and odors. Cumulative impacts to air quality have the potential to be short- to long-term, minor to moderate, and adverse.	Alternative B would result in minor to moderate, adverse impacts to air quality, but these would be short-term and localized. Slash pile and prescribed burning would cause some adverse, direct, short-term, localized smoke and particulate matter emissions. However, there would be less chance of an intense or severe wildland fire, resulting in long-term, moderate, beneficial effects that would offset the minor to moderate, short-term, adverse effects to air quality. Cumulative adverse effects are anticipated to range from minor to moderate, and there would be long-term, moderate, beneficial effects due to the reduction in fuel loading.
Threatened, Endangered, and Sensitive Plant Species	Alternative A would result in short-term, negligible to minor adverse impacts on federally listed plant species, and short-term minor to potentially moderate adverse impacts on other sensitive plant species, depending on the continued possibility of wildland fire occurrence in areas containing these plants. Cumulative impacts to listed plants would be minor and adverse, and limited in extent.	Alternative B would result in short-term negligible adverse impacts to federally listed plant species, and short-term minor adverse impacts to other sensitive plant species, with increased long-term benefits due to the reduced possibility of wildland fire in their preferred habitats. Cumulative impacts would be negligible to minor, adverse, but limited in extent.
Threatened, Endangered, and Sensitive Animal Species	Alternative A would result in minor to moderate short-term adverse impacts to the Mexican spotted owl, mostly due to the greater potential for wildland fires. Other federally listed species would experience no or negligible to minor, short-term effects. Other sensitive animal species that are not federally listed would be affected in the short-term, with minor to potentially moderate impacts. Precautions would be taken to survey for all these species prior to any prescribed burning or thinning. Cumulative impacts would be minor to moderate and adverse, but limited in extent.	Alternative B would result in short-term, negligible to minor adverse impacts to the Mexican spotted owl, and negligible to minor adverse impacts to other federally and state listed species. Most impacts would be short-term and limited to the duration of the fire events. Long-term, minor to moderate beneficial impacts would result from the reduction in fire load, reduced possibility of catastrophic fire, and the opening up of closed canopy fire to create more habitat for various prey species for raptors and owls. Cumulative impacts would be negligible to minor and adverse, and limited to certain areas.
Soils	Alternative A would result in short-term, minor to moderate, adverse impacts to soil resources, with long-term, minor to moderate, beneficial impacts. Cumulative effects would be short- to long-term, minor, and adverse.	Alternative B would result in negligible to minor, adverse effects to soils in the short term, with moderate, beneficial long-term impacts from the re-establishment of a fire-driven nutrient cycle and increased stability of the soil strata, given increased native herbaceous ground cover, and the reduced frequency of unplanned fire suppression activities. Cumulative effects would be localized, short- to long-term, minor and adverse.

Table 9: Comparative Summary of Impacts		
Impact Topic	**Alternative A, No Action**	**Alternative B, Proposed Action/Preferred Alternative**
Vegetation	Alternative A would result in short-term, direct, minor to moderate adverse impacts to vegetation, including higher degrees of plant mortality from high severity fuels in or near the park, as a result of continued fuel buildup in certain areas, with the potential for moderate impacts in the event of a catastrophic fire. Fuel reduction treatments would result in short-term, minor to moderate direct adverse impacts to the target community, but with long-term moderate beneficial impacts as the community recovered over time. Mitigation measures would be implemented to rehabilitate burned areas and limit spread of exotics. Cumulative impacts would be moderate and adverse.	Alternative B would result in short-term, minor to moderate impacts to vegetation in very localized areas for the most part, with much less chance of higher intensity fires and related higher levels of impacts. Increased prescribed fire and mechanical thinning would reduce fuel load and open up areas previously containing high densities of trees and brush, resulting in long-term benefits of restoring a more natural fire regime and ecological process. Mitigation measures would limit adverse impacts from burning, thinning, and herbicide use. Cumulative impacts would be minor to moderate and adverse.
Water Quality and Hydrology	Alternative A would result in short-term, minor to moderate, and adverse impacts to water quality because of the increased chance of wildland fire, resulting in increased runoff of soil and ash into streams, an increase in stream temperature, higher temporary nutrient loading, and possible increased channel erosion with locally long-term, minor to moderate adverse effects expected in case of more extreme and/or widespread fire. Cumulative effects would be short- to long-term, minor, and adverse.	Alternative B would result in short- to long-term, negligible to minor, more localized adverse impacts to water quality. Long-term moderate beneficial effects would result because of the reduced area that would be affected by extensive wildland fires, the lower fire potential, and the controlled and limited locations of prescribed burns that can result in a thick regrowth that limits erosion and sedimentation. Cumulative effects would be short-term, negligible to minor and adverse, with long-term benefits.
Wetlands	Alternative A would result in short-term, minor, direct and indirect adverse impacts to wetlands. Long-term effects would be minor and beneficial as a result of a lower-intensity burn, but could be moderate and adverse on all wetland systems following higher severity fires. Cumulative effects would be generally long-term, minor to moderate and adverse.	Alternative B would result in short-term, negligible, adverse impacts to wetland functions, and minor beneficial effects to wetlands from the release of nutrients. Cumulative impacts would be negligible and adverse.
Natural Soundscapes	Alternative A would result in localized, short-term, minor adverse impacts on natural soundscapes due to noise from wildland fire use, prescribed burning activities, and fire suppression activities, including noise from helicopters, mechanical equipment, and vehicle use. Cumulative effects would be short-term, minor and adverse, but localized.	Alternative B would result in localized, short-term, minor to moderate, adverse impacts on natural soundscapes due to the use of fire suppression and mechanical removal equipment, including helicopters, chainsaws, and off-road vehicles. Cumulative effects would be localized, short-term, minor and adverse.
Wilderness	Alternative A would result in minor to moderate, short-term, direct, adverse impacts on wilderness values due to the risk of a catastrophic fire and the increased human presence in wilderness areas required to support fire suppression efforts. Cumulative effects would be long-term, minor to moderate, and adverse. Analysis of minimum tool requirements would be used in all wilderness areas to keep adverse impacts to minimal levels.	Alternative B would result in short-term, negligible to minor, adverse impacts to wilderness values due to the use of mechanized tools, the presence of work crews, and the additional noise. The effects to wilderness character would be moderate and beneficial due to the reduction in fuel loads, which reduces the risk of catastrophic fire. Cumulative effects would range from negligible to minor and adverse to long-term, minor to moderate, and beneficial. Analysis of minimum tool requirements would be used in all wilderness areas to keep adverse impacts to minimal levels.

Table 9: Comparative Summary of Impacts		
Impact Topic	**Alternative A, No Action**	**Alternative B, Proposed Action/Preferred Alternative**
Wildlife	Alternative A would generally result in minor to moderate adverse impacts to wildlife and wildlife habitat, with short-term adverse impacts giving way to longer-term benefits for some species in areas that have burned but recover with new regrowth and a more open canopy. Cumulative impacts would be moderate and adverse.	Alternative B would result in minor to moderate adverse impacts to wildlife and wildlife habitat, with improving conditions over time and long-term moderate beneficial impacts from the restoration of more natural conditions and the reduction of the possibility of catastrophic wildland fire. Cumulative impacts would be minor to moderate and adverse.
Cultural Resources	Alternative A would result in minor to moderate, adverse impacts on cultural resources. Short-term impacts may occur, but most impacts would be considered long-term due to the non-renewable nature of these resources. Cumulative impacts would be minor to moderate, long-term and adverse from fire, collecting, erosion, and soil/ground disturbance.	Alternative B would result in long-term, minor, adverse impacts to cultural resources, with some moderate, long-term beneficial impacts by eliminating the threat of extensive, high-intensity fires and reducing damaging fuels. Cumulative impacts would be short-term, minor, and adverse, with long-term, moderate beneficial effects.
Economic Considerations	Alternative A would result in short- and long-term, indirect adverse impacts to local socioeconomic conditions, with some beneficial short-term impacts resulting from the revenue generated due to the presence of fire crews. Adverse impacts would include loss of revenue and the cost of suppression and fighting a possibly extreme wildland fire. These impacts would be minor to moderate, depending on the length and severity of the fire, the location of the fire, and when it occurred. Cumulative effects from Alternative A would be short- to long-term, minor to moderate, and adverse.	Alternative B would result in short-term, minor to potentially moderate, adverse impacts to the local economy during the periods of some fuels reduction activities or wildland fire use, which would require restrictions on park use. However, long-term, beneficial impacts would result from the increased protection from costly wildland fires, including both the direct firefighting costs and the indirect costs to the local economy from the reduction in tourism and recreation revenues. Short-term, beneficial impacts would result from the increases in wages and work activities associated with fuel reduction projects or wildland fire use. Cumulative effects to the local economy would range from short-term, minor, adverse to long-term, beneficial impacts from the reduced potential of a large-scale wildland fire.
Park Administration and Visitor Facilities	Alternative A would result in short-term, minor to moderate, adverse impacts to park operations. Cumulative effects would be short-term, minor to moderate, and adverse.	Alternative B would result in short-term, minor to moderate, adverse impacts to park operations. There would be long-term, negligible to minor, adverse impacts to park operations because of more frequent fuel reduction activities. Cumulative effects would be short- to long-term, minor to moderate, and adverse.
Public Health and Safety	Alternative A would result in short- to long-term, minor to moderate, adverse impacts that have more potential to increase if fuels buildup reaches levels that could support an extreme wildland fire. Cumulative effects of this alternative would be short-term, minor to moderate, and adverse primarily because of the risk of a large wildland fire.	Alternative B would result in more localized, short-term, negligible to minor, adverse impacts from the fire and fuels reduction activities expected, but would also provide long-term beneficial impacts resulting from the increased protection from extreme wildland fires, which can create situations with higher health and safety risks. Cumulative effects of this alternative would be short-term, minor, and adverse.
Visitor Use and Experience	Alternative A would result in short-term, minor to moderate, adverse impacts to visitor use and experience, with long-term, minor to moderate, adverse, beneficial effects due to the reduced risk of catastrophic wildland fires. Cumulative effects on visitor use and experience would be short-term, minor to moderate, and adverse.	Alternative B would result in short-term, minor to moderate, adverse impacts to visitor use and experience, as well as moderate beneficial impacts. Cumulative effects would include short-term, minor adverse impacts, as well as long-term, minor to moderate, beneficial impacts.

This page intentionally left blank

AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES

Methodology for Assessing Impacts

In order to analyze the environmental consequences of the alternatives proposed in this document, three factors must be examined for each resource: type of impact, duration of impact, and intensity of impact. After the environmental consequences of the alternatives are examined by separate topic, the impact of implementing the alternative is considered along with the impacts of other relevant actions in the area.

The type of impact describes a relative measure of beneficial or adverse effects on biological or physical systems, cultural resources, or the social environment. Because impacts could have short-term, adverse impacts while having long-term, beneficial impacts, it is important to look at the duration of the effect of an impact.

However, examining only the type and duration of an impact is not enough because an impact could cover a large area or a large portion of a population, or could be highly noticeable or even irreversible. Impacts can vary in intensity, from small and imperceptible to large and substantial. Measures of intensity consider whether an impact would be negligible, minor, moderate, or major. These measures are used to describe both beneficial and adverse impacts.

Cumulative Impacts

Cumulative impacts are also considered in this analysis. A cumulative impact is described in the Council on Environmental Quality regulations (1508.7) as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Cumulative impacts can result from individually minor but collectively major actions taking place over a period of time.

Cumulative impacts of each alternative were addressed by considering the effects of the alternative, combined with the effects of the following past, present, and reasonably foreseeable future actions that were identified in and around the project area:

- Agriculture and local leaf burning in the surrounding region.
- Vehicle use and associated emissions in and around the park (cars, RVs, etc.).
- Use of wood stoves in the surrounding areas.
- The recent addition of the propane–fueled shuttle system within the park (runs April – October).
- Visitor use of the park (related disturbances to soils, soundscapes, vegetation, etc.).
- Park facility development and maintenance (there are no immediate future plans for additional facilities; some have been recently added).
- Fires on adjacent lands (unplanned).
- BLM, U.S. Forest Service (USFS), and other neighboring landowners' use of prescribed fire and other fuel reduction treatments on lands surrounding the park.
- BLM, USFS actions to protect listed species on lands surrounding the park.
- Increasing spread of exotic plant species within the region.
- The continued use of adjacent land for ranching over the years.
- Non-fire aircraft use over/near the park, including commercial flights (new St. George airport), Federal Aviation Administration (FAA)-permitted air tours, helicopter use for maintenance (once per year) and search/rescue (approximately 12 times per year).
- Expected continued growth in the population of neighboring counties and gateway communities.

- Expected continued increasing visitation, especially in backcountry areas of the park.
- Dangers to health and safety from use of the park, especially in the backcountry (e.g., falls, lightning, floods, animals).

Impairment Analysis Method

The *National Park Service Management Policies* (USDI, NPS, 2001c) requires analysis of potential effects to determine whether or not actions would impair park resources or values.

The fundamental purpose of the National Park System, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, actions that would adversely affect park resources and values.

These laws give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of the park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within parks, that discretion is limited by the statutory requirements that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise.

The prohibited impairment is an impact that, in the professional judgment 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 and values. An impact to any park resource or value may constitute impairment. Impairment may result from NPS management activities, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the park. An impact would be more likely to constitute impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- identified as a goal in the park's general management plan or other relevant NPS planning documents.

A determination on impairment is included in the impact analysis section for all impact topics relating to park resources and values.

Air Quality

Affected Environment

Zion National Park is designated a Class I area under the Clean Air Act. This designation means that the least amount of degradation is allowed in air quality characteristics, including visibility, as compared to other Clean Air Act designations. Air quality in the park is generally very good. Current local sources of pollution include particulate matter from campfires and wood stoves, and vehicle emissions. Most air pollution that degrades visibility at the park is from long-distance transport of emissions from regional pollution sources, such as coal-fired generating plants and other sources in large urban areas, including those as far away as northern Utah, southern Nevada, southern California, Arizona, and northern Mexico. Increasing emissions from rapidly growing nearby communities, such as St. George, are also concerns, but the specific impacts have not yet been assessed.

Activities that could lead to a significant impact to air resources, visibility, and other related values of the Class I area must be permitted by the state and certified by the federal land manager (in this case the Assistant Secretary of the Interior for Fish, Wildlife and Parks) as having no significant impact. Additionally, the NPS works actively to identify large sources of regional haze and to use the provisions of the Clean Air Act to reduce their emissions.

National Ambient Air Quality Standards are established under the Clean Air Act to protect public health. Federal and state governments have established regulations under the Clean Air Act specifically to address emissions from wildland fires, and the park is required to work within this regulatory framework. The U.S. Environmental Protection Agency has established an *Interim Air Quality Policy on Wildland and Prescribed Fires*, and the State of Utah has established a *State Implementation Plan* and *Enhanced Smoke Management Plan*. These guidelines provide a process for evaluating the impact of smoke emissions in planning for management fires, state review prior to ignition, public notification before and during fires, and monitoring of emissions during fires.

When wildland fire or prescribed fires are burning, daytime smoke is normally carried to the northeast by the prevailing southwest winds and is usually diluted quickly enough that it is not visually detectable from background levels within a few miles. When nighttime winds are light, downslope winds can carry smoke into drainages that feed into Zion Canyon or North Creek, where it can settle in the communities of Springdale, Rockville, and Virgin, Utah. Most often, however, downward wind flow is strong and smoke is quickly diluted.

Impact Threshold Definitions

Negligible	Changes in air quality would be below or at the level of detection, and if detected, would have effects that would be considered slight.
Minor	Changes in air quality would be measurable, although the changes would be small and the effects would be localized. No air quality mitigation measures would be necessary.
Moderate	Changes in air quality would be measurable and would have consequences, although the effect would be relatively local. Air quality mitigation measures would be necessary and the measures would likely be successful.
Major	Changes in air quality would be measurable, would have substantial consequences, and would be noticed regionally. Air quality mitigation measures would be necessary and the success of the measures could not be guaranteed.
Duration	Short-term – occurs only through the duration of the fire
	Long-term – continues beyond the duration of the fire
Area of Analysis	The Utah listed Smoke Management Airsheds surrounding the park

Effects of Alternative A – No Action Alternative

Under Alternative A, fuel loading would continue to increase, with a continued potential for high-intensity wildland fires during a high-severity fire season and resulting increased emissions periodically originating on park land. The potential for these high intensity fires is based on the continuing variance from historical conditions, creating greater uncontrolled smoke production from the burning of accumulated fuels (such as dense tree canopies, deadfall, ladder fuels, pine needle duff, and grass thatch) that were historically removed by frequent wildland fires. These emissions of air pollutants, including nitrogen oxides (NO_x), carbon monoxide (CO), and particulates, would result in short-term, minor to moderate direct adverse impacts on air quality due to localized exceedences of some air quality standards.

Limited-sized prescribed fires would be used to accomplish fuels reduction objectives. These prescribed fires would have direct and mostly localized, short-term, moderate adverse impacts to air quality, and

indirect, negligible to minor beneficial effects in terms of reduced wildland fire emissions over the long-term. Before undertaking any prescribed fire, a permit application would be prepared that would include the location, size, type of fuels to be treated, estimates of emissions, modeling results showing plume direction, duration of burn, and whether air quality standards would be exceeded for any period of time.

On a regional basis, effects to air quality from both prescribed burns or wildland fire use would generally include minor to moderate, short-term adverse impacts, as large quantities of pollutants, primarily particulates, are released to the atmosphere and travel past monument boundaries. Indirect effects from these air emissions would include smoke and odors, reduced visibility along roadways, reductions in recreation values due to visibility limitations, and possible health effects to sensitive residents and visitors. Mitigation actions to minimize smoke would be carried out under this alternative, including scheduling to avoid high visitor use periods and other scheduled fires in the region, as well as an assessment of fuel conditions, ignition patterns, and other fire management tools to enhance smoke dispersal (see Chapter 2, *Mitigation Measures for Alternative A – Air Quality/Smoke Management*). With the use of these mitigation measures, adverse effects would decrease to minor levels as fuel levels are slowly reduced.

Cumulative Effects

Cumulative effects would include smoke from other wildland fires originating on the surrounding BLM and USFS lands, agricultural and local leaf burning, regional haze resulting from coal fired generating plants, regional haze from urbanized areas, minor emissions from maintenance projects planned for the park, motorized vehicle use in and around the park, and the potential for increased recreational and private development near the park. The severity and duration of impacts would largely depend on the extent of fires in the area and whether or not these occurred at the same time. Overall, impacts of actions under Alternative A, combined with impacts of other actions that could affect regional air quality, would result in minor to moderate, direct and indirect adverse cumulative impacts to air quality.

Conclusion

Alternative A would result in short-term, minor to moderate adverse impacts to air quality because more intense fires would be expected to occur during the prime summer burning period and use of prescribed fire would result in emissions of air pollutants, smoke, and odors. Cumulative impacts to air quality have the potential to be short- to long-term, minor to moderate, and adverse.

Because there would be no major, adverse impacts to air quality whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's air quality resources or values.

Effects of Alternative B – Proposed Action/Preferred Alternative

Alternative B would include either management or suppression of wildland fire and would allow for fuel reduction activities within the park, including mechanical thinning, slash piling, slash pile burning, and prescribed fire. Direct impacts of Alternative B to air quality would be short-term, minor to moderate, and adverse; however, best available control technology would be applied to minimize emissions, and overall impacts would depend on fuel loading and burn intensity and duration.

Short-term, minor to moderate indirect adverse air quality impacts would occur in the area because of potential for wildland fires, coupled with prescribed fire activities. However, the potential for more intense impacts and longer-term impacts would decrease, since fewer areas would have high wildland fire

potential due to prescribed fire treatment, thinning, and establishment of fuel breaks to accomplish suppression activities. Also, with more area now in the Suppression and Modified FMU along the park boundary and less area in the Natural FMU, the use of prescribed fire would increase, allowing for the treatment of more areas that would reduce the risk of a catastrophic fire, resulting in a moderate beneficial impact. Wildland fire use would be conducted at optimum smoke dispersal periods to keep adverse impacts to a minimum. Also, wildland fire use fires burn longer at lower temperature, producing fewer emissions overall than a wildland fire of similar duration.

Prescribed fires ignited to meet resource and protection objectives (i.e., hazard reduction, etc.) and naturally ignited wildland fires managed for resource benefits can collectively reduce years of fuel accumulation, resulting in long-term benefits to regional and local air quality through reduced emissions. Before undertaking any prescribed fire, a permit application would be prepared that would include the location, size, type of fuels to be treated, estimates of emissions, modeling results showing plume direction, duration of burn, and whether air quality standards would be exceeded for any period of time.

Smoke Management. Prescribed fire applications would be carried out in a manner to minimize local effects to visibility and air quality from smoke production. Smoke production and air quality would be monitored prior to ignition and monitored during the operation to ensure that smoke impacts are minimized. Prescribed fire activities would comply with the *Utah Smoke Management Plan* and the National Ambient Air Quality Standards (NAAQS) pursuant to 40 CFR Part 50. Smoke dispersion models would be used to reduce impacts, and mitigation methods would be planned to reduce emissions and increase smoke dilution (see Chapter 2, *Mitigation Measures for Alternative B*).

Cumulative Effects

When combined with regional haze and burns from adjacent landowners and agencies, there is potential for minor to moderate short-term adverse cumulative effects on air-quality-related values under Alternative B. Fire management activities in the surrounding area, emissions from local development and automobiles, and management activities in the park, when viewed together, would result in minor to moderate short-term adverse impacts on air quality. However, protocols are in place to coordinate smoke emissions from all sources within the area. Long-term moderate, beneficial cumulative effects would be expected to occur as fuels are managed to lower levels. Overall, impacts of actions under Alternative B, combined with impacts of other actions that could affect regional air quality, would result in short-term, minor to moderate, direct adverse cumulative impacts to air quality, with long-term, moderate, beneficial, cumulative effects due to the reduction in fuels and reduced risk of a catastrophic wildland fire.

Conclusion

Alternative B would result in minor to moderate, adverse impacts to air quality, but these impacts would be short-term and localized. Slash pile and prescribed burning would cause some adverse, direct, short-term, localized smoke and particulate matter emissions. However, there would be less chance of an intense or severe wildland fire, resulting in long-term, moderate, beneficial effects that would offset the minor to moderate, short-term, adverse effects to air quality. Cumulative adverse effects are anticipated to range from minor to moderate, and there would be long-term, moderate, beneficial effects due to the reduction in fuel loading.

Because there would be no major, adverse impacts to air quality whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's air quality resources or values.

Threatened, Endangered, and Sensitive Plant Species

Affected Environment

The following list (Table 10) was provided through consultation with the US Fish and Wildlife Service (USFWS) (Appendix E). These species may occur within the three counties in which the park lies.

Table 10: Federally Listed Plant Species

Common Name	Scientific Name	Federal Status	Found in Zion? (based on surveys)
Shivwits Milkvetch	*Astragalus ampullarioides*	Endangered	Yes
Jones Cycladenia	*Cycladenia humilis var. jonesii*	Threatened	No
Kodachrome Bladderpod	*Lesquerella tumulosa*	Endangered	No
Navajo Sedge	*Carex specuicola*	Threatened	No
Siler Pincushion Cactus	*Pediocactus sileri*	Threatened	No
Welsh's Milkweed	*Asclepias welshii*	Threatened	No
Dwarf Bear-Poppy	*Arctomecon humilis*	Endangered	No
Holmgren Milkvetch	*Astragalus holmgreniorum*	Endangered	No

One federally-listed endangered plant species, the **Shivwits milkvetch** (*Astragalus ampullarioides*), occurs in Zion. This species was listed in 2001 by the USFWS because of its extremely limited range on the Chinle Formation and its rapidly vanishing habitat due to development (USDI, USFWS, 2001a). In a healthy system, its sparsely vegetated habitat is not prone to fire and thus this milkvetch is not fire-adapted. However, red brome is now invading these areas, creating dense, continuous fuels and a potential threat to this endangered species.

Jones cycladenia (*Cycladenia humilis* var. *jonesii*) is not known to occur in Zion. It grows on gypsiferous, saline soils of the Cutler, Summerville and Chinle Formations in Emery, Garfield, Grand, and Kane Counties in Utah as well as Mojave County, Arizona.

Kodachrome bladderpod (*Lesquerella tumulosa*) is not known to occur in Zion. It is found on white, bare shale knolls (Winnsor Member of the Carmel Formation) among scattered juniper of blue grama grasslands. This plant is known only from Kane County, Utah.

Navajo sedge (*Carex specuicola*) is not known to occur in Zion. This taxon is restricted to Navajo sandstone hanging gardens or seeps and spring pockets on the Navajo Nation, Coconino County, Arizona and San Juan County, Utah.

Siler pincushion cactus (*Pediocactus sileri*) is not known to occur in Zion. This cactus is found on red and gray gypsiferous, seleniferous, calciferous soils and shales of the Moenkopi Formation in Kane and Washington Counties, Utah and Mohave and Coconino Counties, Arizona.

Welsh's milkweed (*Astragalus welshii*) is not known to occur in Zion. It is found exclusively on igneous gravels in western Garfield, eastern Iron, Kane, southeastern Millard, Piute, and Wayne Counties, Utah.

Dwarf bear claw poppy (*Arctomecon humilis*) is not known to occur in Zion. This taxon is restricted to the Shnabkaib, middle red, and Shinarump members of the Moenkopi Formation on rolling low hills and bluffs.

Holmgren's milkvetch (*Astragalus holmgreniorum*) is not known to occur in Zion. A Virgin-Mohave endemic, this taxon occurs in southwestern Washington County, Utah and Mohave County, Arizona.

Zion also hosts 22 plant species considered "sensitive" by the park and the state of Utah because of their limited distribution (endemism) or are disjunct from more abundant population centers. Most of these species are specialized to sandstone crevices and derived soils or hanging gardens. Many of these habitats are not susceptible to fire, and therefore fires are infrequent or rare in areas where these plants may occur. Table 11 lists Zion sensitive plants according to habitat. Charleston's violet and Zion penstemon, grow in more than one habitat type (Atwood et. al 1991, Welsh et. al 1993 and 1995, Welsh 1988).

Table 11: Sensitive Plant Species by Habitat

Common Name	Scientific Name	Fire-prone Habitat	Habitat
Clark's lomatium	*Lomatium graveolens* var. *clarkii*	Yes	Ponderosa pine forest understory or pinyon pine understory
Zion penstemon	*Penstemon humilus* var. *obtusifolia*	Yes	
Higgin's penstemon	*Penstemon leonardii* var. *higginsii*	Yes	
Charleston's violet	*Viola charlestonensis*	Yes	
Bog violet	*Viola clauseniana*	Yes	
Religious daisy	*Erigeron religiosus*	Yes	Dry meadows
Panguitch buckwheat	*Eriogonum panguinense*	Rare	Exposed limestone
Charleston's violet	*Viola charlestonensis*	Rare	
Shivwits milkvetch	*Astragalus ampullarioides* (federally endangered)	Rare	Chinle and Moenkopi Formations[1] (barren badlands)
Springdale buckwheat	*Eriogonum corymbosum* var. *matthewsiae*	Rare	
Chia	*Salvia columbariae* var. *argentea*	Rare	
Zion draba	*Draba asperella*	Rare	Sandstone soils and crevices
Canaan daisy	*Erigeron canaani*	Rare	
James' buckwheat	*Eriogonum jamesii*	Rare	
Zion buckwheat	*Eriogonum racemosum* var. *zionis*	Rare	
Jones' goldenaster	*Heterotheca jonesii*	Rare	
Zion penstemon	*Penstemon humilus* var. *obtusifolia*	Rare	
Utah spikemoss	*Selaginella utahensis*	Rare	
Ruth's sphaeromeria	*Sphaeromeria ruthiae*	Rare	
Foster's columbine	*Aquilegia formosa* var. fosteri	Rare	Hanging garden or wetland
Black spleenwort	*Asplenium adiantum-nigrum*	Rare	
Hays' sedge	*Carex haysii*	Rare	
Zion daisy	*Erigeron sionis*	Rare	
Cliff jamesia	*Jamesia americana*	Rare	

[1] Habitat not fire-prone, but with invasion of red brome fire frequency could dramatically increase

Impact Threshold Definitions

Negligible	No federally listed species or sensitive species would be affected or the alternative would affect an individual of a listed species, its critical habitat, or a sensitive species, but the change would be so small that it would not be of any measurable or perceptible consequence to the protected individual or its population.
Minor	The alternative would affect an individual(s) of a listed species, its critical habitat, or a sensitive species, but the change would be small.
Moderate	An individual or population of a listed species, its critical habitat, or a sensitive species would be noticeably affected. The effect would have some consequence to the individual, population, or habitat.
Major	An individual or population of a listed species, its critical habitat, or a sensitive species would be noticeably affected with a vital consequence to the individual, population, or habitat.
Duration	Short-term - recovers in less than one year
	Long-term – requires more than one year to recover
Area of Analysis	Within park boundary

Effects of Alternative A – No Action Alternative

Federally Listed Species

Of the eight federally listed plant species that occur within the three counties in which the park lies, only one, the Shivwits milkvetch (*Astragalus ampullarioides*) occurs in Zion. This plant has been observed in only a small area in the southwestern portion of the park, on the Chinle formation, within the Boundary FMU. This area is not likely to sustain a large fire due to its current vegetative condition (basically, a barren badland with sparse vegetation). In the Boundary FMU, wildland fire use is permitted when fire danger is low to moderate; however, neither wildland fire use nor prescribed burns would be conducted in areas of known listed species. Any fire that would occur in the area containing this plant species would be suppressed, thereby limiting adverse impacts. Since the area in which the Shivwits milkvetch is found is unlikely to sustain fire, and any fire would be suppressed, adverse impacts to the Shivwits milkvetch under Alternative A would be short-term, negligible to minor, and localized. Therefore, Alternative A may affect, but is not likely to adversely affect, the Shivwits milkvetch.

State-Listed or Other Sensitive Species

Of the other sensitive plant species (i.e., those that are not federally listed but are recognized as rare or of special concern), only six would be expected in habitats that would be affected by fire; the remainder would not be expected to incur adverse impacts from fire because they are not found in fire-prone habitats (see Table 11). Of those six species, the Religious daisy (*Erigeron religiosus*) occurs in dry meadows, and the other five occur in ponderosa pine or pinyon pine understories. Under Alternative A, these types of habitats could be affected by wildland fires, and because these areas currently do not have an extensive prescribed fire or mechanical fuel reduction program, the possibility of wildlife would continue. However, if fire were to occur, suppression would be used in areas where these species are known to occur in order to limit damage to the resource. Any prescribed burning would be preceded by sensitive plant surveys. If any of these species were found, their habitat would be avoided. Overall, adverse impacts to these species under Alternative A would be mostly short-term and minor to potentially moderate, but possibly widespread, since ponderosa pine and pinyon pine habitats are quite extensive throughout the park.

Cumulative Impacts

Cumulative impacts to listed plant species include the actions described under Alternative A, plus disturbances from past fires in and outside the park. Suppression of fire in these areas over the years has led to condition of high fuel buildup where state-listed or sensitive species could be affected, but the FMP and other proactive fuels reduction now occurring on public and neighboring lands are decreasing this potential adverse impact. Other impacts to listed plants include slight potential for trampling or disturbance from visitor use in backcountry; however, most visitors stay on trails and do not encroach into habitats that support these species. Beneficial cumulative impacts have occurred from the protective measures taken by the park and other surrounding federal and state land agencies to identify and protect habitats. Overall, impacts from actions under Alternative A, combined with impacts of other actions that could affect listed species, would result in minor adverse cumulative impacts to listed plant species, limited to certain areas and primarily to ponderosa and pinyon pine understories.

Conclusion

Alternative A would result in short-term, negligible to minor adverse impacts on federally listed plant species, and short-term minor to potentially moderate adverse impacts on other sensitive plant species, depending on the continued possibility of wildland fire occurrence in areas containing these plants. Cumulative impacts to listed plants would be minor and adverse, and limited in extent.

Because there would be no major, adverse impacts to threatened and endangered plant species or other sensitive plant species whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant NPS planning documents, there would be no impairment of the park's threatened and endangered plant species or other sensitive plants.

Effects of Alternative B – Proposed Action/Preferred Alternative

Federally Listed Species

Under Alternative B, the area containing the Shivwits milkvetch (federally endangered) would be redesignated as part of the Suppression or Modified FMU, with increased emphasis on suppression and a reduced chance of wildland fire use being selected as a response to wildland fire. The area containing the plant is not likely to sustain fire, and the plant would be protected during any fire response. Prescribed burns would not occur in the area without plant surveys. Also, under Alternative B, much of the surrounding area would be in the Modified or Conditional FMU, rather than the Natural FMU, with more fuel reduction projects planned. This would reduce the possibility of catastrophic wildland fire in the general area, so that there would be less chance of wildland fire spreading into the milkvetch habitat — a minor beneficial impact. With these conditions and mitigation measures in place, adverse impacts to the Shivwits milkvetch under Alternative B would be short-term, negligible, and localized. Therefore, Alternative B may affect, but is not likely to adversely affect, the Shivwits milkvetch.

State-Listed or Other Sensitive Species

Compared to Alternative A, Alternative B would decrease the potential for catastrophic wildland fire because more areas would be targeted for fuels reduction through use of prescribed fire or mechanical and possibly herbicide applications, and fire management would be done in partnership with neighboring land agencies. Any fuel reduction treatment area would be surveyed for the presence of these sensitive species before treatments progressed, and appropriate steps would be taken to avoid or minimize adverse impacts before treatment proceeded. With the decreased chance of extreme wildland fires under Alternative B, adverse impacts would be short-term, negligible to minor, and more limited in extent. Also, the actions taken under Alternative B would result in minor to potential moderate, long-term beneficial impacts to

these species based on the reduced chance of catastrophic fire. In addition, use of low intensity prescribed fire and clearing of areas can open up the pine canopy, release nutrients, and allow water to reach the ground, which would promote seed germination of listed species — an additional beneficial effect.

Cumulative Impacts

Cumulative impacts to listed plant species under Alternative B would be very similar to those described for Alternative A, with potential short-term minor to moderate adverse impacts in pine understories if wildland fire use was selected as the appropriate response and the presence of sensitive species was not known. However, in the long term, the increased fuel reduction planned for ponderosa and pinyon pine areas would help to limit adverse impacts from catastrophic wildland fires and provide improved soil and canopy conditions for increased growth in the areas treated. Overall, impacts from actions under Alternative B, combined with impacts of other actions that could affect listed species, would result in negligible to minor, adverse cumulative impacts to listed plant species, limited to certain areas.

Conclusion

Alternative B would result in short-term, negligible adverse impacts to federally listed plant species, and short-term minor adverse impacts to other sensitive plant species, with increased long-term benefits due to the reduced possibility of wildland fire in their preferred habitats. Cumulative impacts would be negligible to minor, adverse, but limited in extent.

Because there would be no major, adverse impacts to threatened and endangered plant species or other sensitive plant species whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant NPS planning documents, there would be no impairment of the park's threatened and endangered plant species or other sensitive plants.

Threatened, Endangered, and Sensitive Animal Species

Affected Environment

The animal species listed in Table 12 and described below either occur or have the potential to occur within Zion. The list is based on consultation with the USFWS (Appendix E).

Table 12: Federally Listed and Candidate Animal Species

Common Name	Scientific Name	Federal Status	Found in Zion?*
Mexican Spotted Owl	*Strix occidentalis lucida*	Threatened	Yes
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	Yes
California Condor	*Gymnogyps californianus*	Endangered	Yes
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	Candidate	Yes
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Endangered	Yes
Desert Tortoise	*Gopherus agassizii*	Threatened	Yes
Utah Prairie Dog	*Cynomys parvidens*	Threatened	No
Kanab Ambersnail	*Oxyloma haydeni kanabensis*	Endangered	No
Coral Pink Sand Dune Tiger Beetle	*Cincindela limbata albissima*	Candidate	No

Table 12: Federally Listed and Candidate Animal Species			
Common Name	**Scientific Name**	**Federal Status**	**Found in Zion?***
Colorado Pikeminnow	*Ptychocheilus lucius*	Endangered	No
Razorback Sucker	*Xyrauchen texanus*	Endangered	No
Virgin River Chub	*Gila seminuda*	Endangered	No
Woundfin	*Plagopterus argentissimus*	Endangered	No

*Based on surveys, staff knowledge, available habitat, and known range.

Zion is within the Colorado Plateau Recovery Unit for the **Mexican spotted owl** (*Strix occidentalis lucida*), which is federally listed as a threatened species. The Mexican spotted owl reaches the northwestern limits of its range in this recovery unit (USDI, NPS, 2001), and all of Zion is designated as critical habitat for this species. Zion has 17 (possibly 18) known Mexican spotted owl territories, which are widely distributed (USDI, NPS, 2001). A spotted owl monitoring program for the park was initiated in 1995. Catastrophic fire and timber harvest within upland forests, which are potentially used for foraging, dispersal, and wintering, are considered threats to spotted owl populations (USDI, USFWS, 1995a).

The **Bald eagle** (*Haliaeetus leucocephalus*), a federally threatened species, winters in the vicinity of the park, especially in the Sevier River Valley east of the park. Although they are commonly observed near the Blue Creek Reservoir to the north, only a few bald eagles are observed each year in the park during the winter and early spring months, and birds occasionally entering the park perch along the North Fork of the Virgin River. Bald eagle use in the park is sporadic, uncommon, and unpredictable. Large congregations of the birds do not occur, and there are no known, regularly used, winter perch sites or known roost sites within the park.

A nonessential, experimental population (Section 10(j) of the Endangered Species Act) of the federally endangered **California condor** *(Gymnogyps californianus)* was reintroduced into northern Arizona. The condor must be treated as a listed threatened species under the 10(j) designation in the park. During the summer of 2004, 10 to 14 condors extensively used the area north of the park and were known to foray regularly into the park during that time. In the spring of 2003, condors were also seen in the park over several days. The condors appear to be expanding their range farther to the north and may be expected to visit Zion more frequently in the future. They currently are not known to use the park year-round, and do not use the park as a breeding area.

The **western yellow-billed cuckoo** *(Coccyzus americanus occidentalis)* has candidate species status and is considered a rare summer resident and migrant in the park (Wauer, 1997). No more than a few sightings occur each year. Their primary breeding habitat is an overstory of cottonwood canopy that is present in the park, but cuckoos have not been known to breed in the park (Wauer, 1997).

The federally endangered **southwestern willow flycatcher** (*Empidonax traillii extimus*) nests primarily in mid-to-low elevation riparian habitat along rivers, streams, or other wetlands where a dense growth of willows or other plants are present. There was one confirmed sighting of this neotropical migrant in the park in 1994 along the East Fork of the Virgin River. A 1998 survey of the park's riparian habitat that seemed capable of supporting flycatchers found no birds, although several pairs have been found downstream of the park along the Virgin River. One bird was located in the Birch Creek survey area in 1999 but apparently was a migrant (USDI, NPS, 2001).

A small population of federally threatened **desert tortoises** (*Gopherus agassizii*) occurs in one limited area that encompasses both park land and adjacent BLM lands. A study was completed in 2003 using

Line Distance Sampling techniques, which resulted in an average of 14 individuals, with a 95 percent confidence interval from 12 to 26 individuals (P. Stephen Corn, personal communication). The Upper Virgin River recovery plan unit for the tortoise does not encompass lands within the park, and there is no critical habitat designated within the park (USDI, NPS, 2001). Areas where desert tortoises occur are not likely to burn because of the sparse vegetation. However, increasing non-native annual plants could increase the frequency and severity of fire in the area.

The **Utah prairie dog** (*Cynomys parvidens*), a federally threatened species, has not been recorded in nor is it believed to occur within the park. However, the southern tip of the prairie dog's range is close to Zion's northern border and the park may be within the species' dispersal range. Open grasslands that cover plateaus in the northernmost portion of the park would be the most likely areas the prairie dog would colonize (USDI, NPS, 2001).

A survey for the **Kanab ambersnail** *(Oxyloma haydeni kanabensis)* was conducted in the East Fork of the Virgin River in Parunuweap Canyon in August 2001 (Utah Division of Wildlife Resources (UDWR), 2001). No Kanab ambersnails were found in that survey or anywhere else in the park. Kanab ambersnails are found in three distinct localities: Three Lakes and Kanab Creek in Utah, and another population in Arizona (UDWR, 2001). All of these areas are disjunct from the park.

Coral Pink Sand Dunes tiger beetle *(Cincindela limbata albissima)* is not found in Zion. Its distribution is limited to the sand dunes within Coral Pink Sand Dunes State Park and also on adjacent lands managed by the Bureau of Land Management (USDI, USFWS, 1997).

The **Colorado pikeminnow** *(Ptychocheilus lucius)* is not found in Zion. The Colorado River in Glen Canyon National Recreation Area is the closest distribution of the fish (USDI, USFWS, 2002).

Razorback suckers *(Xyrauchen texanus)* are not found in Zion. Their closest distribution is along the Colorado River near Lake Powell (Sigler and Sigler, 1996).

Virgin River chub *(Gila seminuda)* does not occur in Zion. The distribution begins south of the park in the Virgin River below LaVerkin, Utah (USDI, USFWS, 1995b).

Woundfin *(Plagopterus argentissimus)* are not found in Zion. Their closest distribution is located in the Virgin River below LaVerkin, Utah (Sigler and Sigler, 1996).

The following wildlife species are either known to breed in the park, are under conservation agreements, or are listed as a Utah sensitive species.

Although the **peregrine falcon** *(Falco peregrinus anatum)* was removed from the federal list of endangered and threatened species in 1999, Zion has continued to monitor territories associated with climbing routes. Zion is known to have 19 historic falcon territories. A subset of those territories and the climbing route territories are monitored each year (USDI, NPS, 2001d).

Several nests of breeding **northern goshawks** *(Accipiter gentilis)* have been found in the park (USDI, NPS, 1999). Before prescribed burns are ignited, goshawk surveys are conducted in areas of likely goshawk habitat. All nests are located and recorded by using a global positioning system (GPS) for future reference.

The **Virgin spinedace** *(Lepidomeda mollispinis mollispinis)* is managed under a Conservation Agreement in lieu of listing as a threatened species. Virgin spinedace are found in the North Fork and East Fork of the Virgin River and several tributaries within and beyond the park. Since 1994, the Utah Division of

Wildlife Resources (UDWR) has been monitoring the spinedace at two park locations (UDWR, 2003). In 2002, several additional locations were added in the North Fork of the Virgin River near the Zion Lodge. Monitoring of this species will continue annually.

Impact Threshold Definitions

Negligible	No federally listed species or sensitive species would be affected, or the alternative would affect an individual of a listed species, its critical habitat, or sensitive species, but the change would be so small that it would not be of any measurable or perceptible consequence to the protected individual or its population.
Minor	The alternative would affect an individual(s) of a listed species, its critical habitat, or sensitive species, but the change would be small.
Moderate	An individual or population of a listed species, its critical habitat, or sensitive species would be noticeably affected. The effect would have some consequence to the individual, population, or habitat.
Major	An individual or population of a listed species, its critical habitat, or sensitive species would be noticeably affected with a vital consequence to the individual, population, or habitat.
Duration	Short-term - recovers in less than one year
	Long-term – requires more than one year to recover
Area of Analysis	Within park boundary

Effects of Alternative A – No Action Alternative

Federally Listed Species

Six federally listed species are known to occur in Zion (see Table 12). Seven federally listed or candidate species are known to occur in the proximity of Zion. The potential impacts of Alternative A are described for each of these below.

Mexican Spotted Owl (Threatened): This species is known to occur within the park, and there are 17 (possibly 18) known spotted owl territories, which are widely distributed throughout all four FMUs. The Mexican spotted owl nests in slot canyons, which are not very susceptible to fire, due to the sparseness of the vegetation. However, the Mexican spotted owl does use nearby upland forests for foraging, dispersal, and wintering. Under Alternative A, the area in the park interior bordering the slot canyons would be more likely to experience extreme wildland fires, which could result in an adverse effect on the owl's foraging or wintering habitat. Also, aircraft use during fire-fighting efforts could affect the spotted owl if the flights approach close to owl territories (Delaney et. al., 1999). However, any flights would avoid known owl territories to the extent possible. Impacts from prescribed burns would be negligible to minor, since such burns would not occur during the nesting season. Adverse impacts under Alternative A would be expected to be short-term and minor to possibly moderate if wildland fire would occur near owl territories. Therefore, since current practices would persist, unnatural fuel buildup could continue over time, and Alternative A may affect, and is likely to adversely affect, the Mexican Spotted Owl.

Bald Eagle (Threatened): This species is occasionally seen in the park as a winter visitor only. Large numbers do not occur in the park, no breeding occurs, and there are no known regularly used perched sites. Adverse impacts would be negligible, and Alternative A would have no effect on the bald eagle.

California Condor (Endangered): The California condor is a summer visitor and does not breed in the park. Aircraft use during fire-fighting efforts could affect the California Condor if the flights approach close to individual condors or roosting areas. However, any flights would avoid known condor areas to the extent possible. Since current practices would persist, unnatural fuel buildup could continue over

time. Therefore, adverse impacts would be minor, and Alternative A may affect, and is likely to adversely affect, the California condor.

Western yellow-billed Cuckoo (Candidate): The bird is a rare summer resident and migrant. Its preferred breeding habitat of mature cottonwood trees is very limited in the park, and this species is not known to breed in the park. Any fires that would occur in the riparian areas of the park are unlikely to be sustained because of the wetter conditions there, and most fires in the riparian areas would be suppressed. Therefore, impacts would be negligible and Alternative A would result in no effect on the yellow-billed cuckoo.

Southwestern Willow Flycatcher (Endangered): This bird also prefers riparian habitat, but is found primarily in dense willows or other riparian shrubs. This habitat is very limited in the park, and a survey done in 1998 found no Southwestern willow flycatchers in the park. Any area that could support these birds would not be targeted for fuel treatment projects, except for exotic plant treatments, which would include surveys for listed species prior to any implementation. Any fires in riparian areas would likely be very limited and suppressed. Given all these considerations, impacts to Southwestern willow flycatcher would be negligible, and Alternative A would have no effect on the Southwestern willow flycatcher.

Desert Tortoise (Threatened): A small population of desert tortoise is found only in one area of the park (southwestern corner), and this area is generally not susceptible to fire due to its sparse desert-like vegetation cover. However, increased exotic grass cover may lead to fast-acting fires that could threaten individual tortoises, although their dens would not likely be affected. If fire were to occur, it would be suppressed in areas known to support this species, and therefore impacts would be minor. Alternative A may affect, and is likely to adversely affect, the desert tortoise.

Utah Prairie Dog (Threatened): This species is not known to occur within the park, although the southern tip of its range is close to the park's northern border. Alternative A would therefore have no effect on this species.

All Other Listed Species: Kanab Ambersnail (Endangered), Coral Pink Sand Dune Tiger Beetle (Candidate), Colorado Pikeminnow (Endangered), Razorback Sucker (Endangered), Virgin River Chub (Endangered), Woundfin (Endangered). None of these species is known to occur in Zion, based on staff knowledge and past surveys. Four of these are fish (Colorado pikeminnow, razorback sucker, Virgin River chub, and woundfin), but none of these species is known to occur in immediate downstream areas. The Virgin River chub has the closest known distribution to the park (Virgin River below LaVerkin), but is far enough downstream that any water quality effects relating to fire would be reduced with time and distance from the fire. Therefore, Alternative A would have no effects on these other listed species.

State-Listed or Other Sensitive Species

Three other species that are considered sensitive, but are not federally listed, could be affected by fire and fire management activities under Alternative A.

Peregrine Falcon: There are 19 historic peregrine falcon territories within Zion, many of which are monitored yearly. Peregrine falcons nesting in or near areas subject to fire could be adversely affected by smoke and fire-fighting activities; however, most would vacate the affected area and return later. Prescribed burns would not be conducted if active nests are found, and measures would be taken to limit adverse impacts from nearby burns or clearing by limiting thinning and burning to outside the breeding season. Burning may result in better habitat for prey species, as herbaceous and shrub cover returns — a

beneficial impact. Impact to the peregrine falcon from Alternative A would be short-term, minor and localized.

Northern Goshawk: This species nests in the park, and several nest locations have been recorded. Noise and smoke impacts from fire and fire-fighting activities in the areas of nesting would have short-term, minor impacts, and any fires that would occur in nesting habitat would result in short-term, minor to moderate impacts on individuals, but these impacts would not cause widespread effects on the species. Prescribed burns would not be conducted if active nests are found, and measures would be taken to limit adverse impacts from nearby burns or clearing by limiting thinning and burning to outside the breeding season and removing burnable fuels from around nest trees prior to burning. Burning may result in better habitat for prey species, as herbaceous and shrub cover returns — a beneficial impact. Impacts to the Northern goshawk from Alternative A would be mostly short-term, minor, and localized.

Virgin spinedace: The Virgin spinedace is found in tributaries within and beyond the Park. If wildland fire were to occur and become widespread or severe prior to suppression, resultant impacts could occur to surface waters (see *Water Quality*) that could indirectly affect this species. However, it would be expected that the spinedace would swim away from affected areas immediately, and relocate to other habitat if water quality began to deteriorate in the vicinity of the fire due to increased ash or soil runoff. If fire occurred during or before spawning, minor to moderate, short-term adverse impacts to spawning beds could occur from deposition of ash. Prescribed burning and clearing would be done in limited areas and would not affect this species. Because of the increased possibility of catastrophic fire under Alternative A, there could be minor to moderate, short-term impacts to the species in certain park tributaries.

Cumulative Impacts

Cumulative impacts to listed animal species include the actions under Alternative A, plus disturbances from past fires in and outside the park. Suppression of fire in these areas over the years has led to conditions of high fuel buildup where state-listed or sensitive species could be affected, but the FMP and other proactive fuels reduction now occurring on public and neighboring lands are decreasing this potential adverse impact. Other impacts to listed animals include slight potential for disturbance from visitor use in backcountry; however, most visitors stay on trails and do not encroach into habitats that support these species. Beneficial cumulative impacts have occurred from the protective measures taken by the park and other surrounding federal and state land agencies to identify and protect habitats. Overall, impacts of actions under Alternative A, combined with impacts of other actions that could affect listed species, would result in minor to moderate, adverse, cumulative impacts to listed animal species, limited to certain areas.

Conclusion

Alternative A would result in minor to moderate short-term adverse impacts to the Mexican spotted owl, mostly due to the greater potential for wildland fires. Other federally listed species would experience no or negligible to minor, short-term effects. Other sensitive animal species that are not federally listed would be affected in the short-term, with minor to potentially moderate impacts. Precautions would be taken to survey for all these species prior to any prescribed burning or thinning of areas. Cumulative impacts would be minor to moderate and adverse, but limited in extent.

Because there would be no major, adverse impacts to threatened and endangered animal species or other sensitive animal species whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant NPS planning documents, there would be no impairment of the park's threatened and endangered animal species or other sensitive animals.

Effects of Alternative B – Proposed Action/Preferred Alternative

Federally Listed Species

Under Alternative B, the additional fuel reduction treatments and use of wildland fire in appropriate situations would reduce fuel loads in many areas over time, resulting in a substantially decreased chance of catastrophic wildlife and a long-term beneficial impact for all federally listed species that occur within the park. Species impacts related to specific actions proposed under Alternative B are addressed below.

Mexican Spotted Owl: Alternative B could result in some short-term, adverse impacts to this owl due to disturbance from thinning hazardous fuels or conducting prescribed burns in areas near known owl nesting sites in nearby slot canyons. Prescribed fire and mechanical treatments conducted in the general vicinity of foraging habitat could cause minor, adverse indirect effects, but would result in the eventual increase in grasses and forbs that support the owl's prey base of mice, voles, and other small rodents — a beneficial effect. Other mitigation measures used to reduce potential impacts include restricting low altitude use of fire aircraft within a 105 meter radius of known spotted owl tributaries during the breeding season (March 1 – August 31), using recovery plan recommendations for use of aircraft, leaving snags and cavity-bearing trees in place when reducing fuel loads, avoiding the removal of all woody debris (to leave habitat for small mammal species), using manual fire reduction in sensitive areas, and coordinating with USFWS before any planned fuel treatments in order to comply with all ESA and Recovery Plan requirements to ensure no long-term, adverse impacts occur. With the implementation of these measures, Alternative B would result in short-term, negligible to minor adverse impacts due to the limited work crew presence, noise, and minor disruption of habitat for the owl and its prey species, and a moderate beneficial impact due to the reduction of wildland fire threat and improved habitat for prey. Overall, Alternative B may affect, but is not likely to adversely affect, the Mexican Spotted Owl.

Bald Eagle: Adverse impacts under Alternative B would be the same as under Alternative A (negligible) for this species, since it is not known to inhabit the park or frequently use it. Prescribed fire, mechanical thinning, and/or suppression actions would not adversely affect this species, since it can easily vacate the affected areas and use nearby areas for feeding, perching, and nesting. Beneficial effects may occur if thinning and controlled fire lead to regrowth of understory plants and ground cover, improving habitat for prey species. Alternative B would have no effect on the bald eagle.

California Condor: Prescribed fire, mechanical thinning, and/or suppression actions would not adversely affect this species, since they can easily vacate the affected areas and use nearby areas for feeding, perching, and nesting. Beneficial effects may occur if thinning and controlled fire lead to regrowth of understory plants and ground cover, improving habitat for prey species. Before initiating prescribed fire and mechanical treatments, Peregrine Fund personnel (who are contracted by USFWS to monitor the condor) would be contacted to determine where condors are roosting and frequenting. Mitigation measures to avoid individual condors and roosting areas would be followed before prescribed fire and mechanical measures are taken. Overall, Alternative B may affect, but is not likely to adversely affect, the California Condor; impacts would be negligible.

Yellow-billed Cuckoo and Southwestern Willow Flycatcher: As previously noted, neither of these species is known to breed in the park. Also, their preferred riparian habitat is very limited within the park and would not be a priority target for thinning or burning, although some treatment for control of exotics may occur in selected riparian areas. If any treatment was proposed in riparian areas, surveys would be done to determine if either species were present, and actions would be taken to limit impacts to either species, including avoidance of nesting seasons and limits on use of herbicides. Adverse impacts to either species under Alternative B would be negligible, and Alternative B would have no effect on these species.

Desert Tortoise: As previously noted, desert tortoise habitat is limited to a small portion of the park that is not susceptible to fire because of its sparse desert-like vegetation. However, increased exotic grass cover may lead to fast-acting fires that could threaten individual tortoises, although their dens would not likely be affected. Fuel reduction treatments for exotic annual grasses would be proposed for the area, and any such treatments planned for nearby locations would include a survey for desert tortoise prior to initiating the fuel reduction program. Therefore, adverse impacts would be negligible, and Alternative B may affect, but is not likely to adversely affect, the desert tortoise.

Utah Prairie Dog: Because this species is not known to inhabit the park, impacts for Alternative B would be the same as Alternative A; i.e., no effect expected.

Other Federally Listed Species: Kanab Ambersnail (Endangered), Coral Pink Sand Dune Tiger Beetle (Candidate), Colorado Pikeminnow (Endangered), Razorback Sucker (Endangered), Virgin River Chub (Endangered), Woundfin (Endangered). Impacts under Alternative B would be the same as Alternative A for all these species – no adverse effects – because they are not known in the park or in immediate downstream reaches. Any herbicides used that could reach waterways would be approved for use near water and would not be applied if they presented a potential damage to aquatic life. As described under mitigation for this alternative, any herbicides used in or near riparian areas or waterways would be applied according to label restrictions. In the long-term, impacts would be beneficial due to the reduced possibility of extreme wildland fire and the associated erosion and resulting impacts to water quality.

State-Listed or Other Sensitive Species

Peregrine Falcon: Impacts to peregrine falcons under Alternative B would be similar to Alternative A, with a reduced chance of wildland fire that could cause smoke and noise-related short-term impacts. Long-term beneficial impacts would result from the herbaceous and shrub cover that is stimulated in burned or cleared areas, resulting in new prey habitat. Overall, Alternative B would have minor, short-term and localized adverse impacts on the peregrine falcon, with some long-term benefits in localized treated areas.

Northern Goshawk: Impacts to the Northern goshawk under Alternative B would be similar to Alternative A, but with a reduced possibility of more extreme fire and the associated moderate parts that would occur if fire were to start in areas of goshawk nesting. Impacts would include short-term, minor adverse effects from fire-related activities in localized area, and long-term beneficial impacts from the west of better prey habitat in selected areas.

Virgin spinedace: Impacts to the Virgin spinedace would be similar to Alternative A, but with a much reduced possibility of ash entering and smothering spawning areas. Therefore, impacts would be expected to be short-term, negligible to minor, and localized.

Cumulative Impacts

Cumulative impacts to listed animal species under Alternative B would be very similar to those described for Alternative A. There would be potential short-term minor to moderate adverse impacts if wildland fire use inadvertently affected some species that were not known to exist in affected areas. However, in the long term, the additional fuel reduction activities and cooperation with neighboring agencies and landowners would help to limit adverse impacts from catastrophic wildland fires and to provide improved soil and canopy conditions for increased ground cover and understory plant growth in treated areas. Overall, impacts of actions under Alternative B, combined with impacts of other actions that could affect listed species, would result in negligible to minor, adverse, cumulative impacts to listed animal species, limited to certain areas.

Conclusion

Alternative B would result in short-term, negligible to minor adverse impacts to the Mexican spotted owl, and negligible to minor adverse impacts to other federally and state listed species. Most impacts would be short-term and limited to the duration of the fire events. Long-term, minor to moderate beneficial impacts would result from the reduction in fuel load, reduced possibility of catastrophic fire, and the opening up of closed canopy, which improves habitat for prey species for raptors and owls. Cumulative impacts would be negligible to minor and adverse, and limited to certain areas.

Because there would be no major, adverse impacts to threatened and endangered animal species or other sensitive animal species whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant NPS planning documents, there would be no impairment of the park's threatened and endangered animal species or other sensitive animals.

Soils

Affected Environment

With very few exceptions, soils in the park are young, very well drained, easily eroded, and low in fertility. Rock and stony rock lands make up half of the 36 soil complexes that occur in the park. Over 80 percent of the soils have low productivity or high erosion potential. Exposures of slickrock, where little soil exists at all or exists only in small pockets and drainage bottoms, cover large areas of the park. Vegetation in these areas is typically sparse, though the variety of species is often great and includes a number of endemic species. Some plants also take advantage of the additional water running off the slickrock to grow at lower elevations than would otherwise be expected.

Shallow soils are more extensive on mesa tops, slopes, and terraces. These areas are often very gravelly or rocky. Some development of soil horizons and structure may occur on flatter slopes. Though soils on steep slopes are often little more than ground bedrock with very little soil development and a large proportion of gravel and boulders, they can still support a moderate density and diversity of plants.

Deep soils are typically confined to river terraces and floodplains, as well as isolated pockets on some of the flatter upland terraces. These are some of the park's most productive soils, particularly where watered by rivers and streams. Older and higher river terraces are more arid and prone to erosion from natural incision and human causes.

Very few small, isolated pockets of poorly drained, or organic rich soils exist in natural wetlands, artificial impoundments, and areas where large landslides have impounded natural streams. These areas are widely scattered and are generally less than 1 acre in size.

The degree of litter and plant cover varies directly with precipitation, which is closely tied to elevation. Soils at the more moist, high elevations tend to have better litter cover and are therefore more resistant to erosion. At drier, low elevations, the amount of soil surface unprotected by litter or plant cover will often exceed 50 percent. In some areas, particularly those with shallow soils, gravel and rock on the soil surface provide some protection from raindrop impact and resistance to wind and water erosion.

Zion also contains notable amounts of biological soil crusts where the soil surface is bound together by a community of algae, fungi, lichen, and other microorganisms. This soft crust greatly increases the soil's ability to capture and hold water, fix nitrogen from the atmosphere, and resist erosion from wind, raindrop impact and flowing water (Belnap et. al., 2001). These soils are sensitive to compression, especially when

the crusts are dry and brittle. The time necessary for recovery depends on the magnitude and frequency of disturbance and the weather conditions. Minor disturbances can recover function within a few storm cycles, while areas of extensive disturbance can take several decades to fully recover.

Zion does not have detailed field surveys to determine the distribution of biological soil crusts. However, these crusts are typically associated with open canopies and sandy soil usually found in pinyon/juniper woodlands and desert-shrub communities. Using existing vegetation and soils information, a model of the distribution of biological soil crusts in the park predicts that they occur on 74,700 acres, or about 50 percent of the park land surface.

Impact Threshold Definitions

Negligible	Soils would not be affected or the effects to soils would be below or at the lower levels of detection. Any effects to soil productivity or fertility would be slight.
Minor	The effects to soils would be detectable. Effects to soil productivity or fertility would be small, as would the area affected. If mitigation were needed to offset adverse effects, it would be relatively simple to implement and likely successful.
Moderate	The effect on soil productivity or fertility would be readily apparent and result in a change to the soil character over a relatively wide area. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.
Major	The effect on soil productivity or fertility would be readily apparent and would substantially change the character of the soils over a large area in and outside of the park. Mitigation measures to offset adverse effects would be needed and would be extensive; their success could not be guaranteed.
Duration	Short-term - recovers in less than three years
	Long-term – requires more than three years to recover
Area of Analysis	Within park boundary

Effects of Alternative A – No Action Alternative

Under Alternative A, soils would be affected by the duration and intensity of a wildland fire and the fire suppression activities used to control the fire. A high intensity fire eliminates organic cover, decreases soil nutrients, increases soil pH, and allows for the formation of hydrophobic soils. As time passes, the loads in and near the park would become denser, with greater fuel loads and greater duff thickness. More severe wildland fires could result and become more intense during dry periods. Under Alternative A, wildland fire use and prescribed fire would have short-term, minor to moderate, adverse impacts on park soil resources. Although it is not anticipated that the short-term impacts of these treatments would impact soil productivity and overall stability, there would be long-term, adverse impacts to soils from the increased risk of high intensity wildland fires.

The more severe fires expected under Alternative A would have several impacts on park soils. McNabb et al. (1990) state that "natural wildfires … have a far greater potential to seriously affect soil fertility than current prescribed burns … because the weather is usually more severe and fuel moistures are normally lower." Erosion resulting from decreased vegetative cover after high-intensity fires, particularly on those lands with steep slopes or following intense rainfall events, would result in both short-term and long-term, minor to moderate, direct adverse impacts to soil stability. Fires of high intensity and severity eliminate organic cover, decrease soil nutrients, kill soil microorganisms that are critical to soil fertility, increase pH, and alter the soil structure (Walstad 1990). Intense fire can create hydrophobic soils, which repel water and result in decreased infiltration, which can alter soil hydrology and promote erosion. These

direct effects of wildland fire are generally short-term and localized, but accelerated erosion and increased sedimentation may impact the area over the long term, depending on soil types and fire severity.

Equipment used to suppress, control, or contain wildland fire, including use of heavy equipment or the construction of firebreaks, would also have short-term, minor to moderate, adverse impacts to park soil resources. The use of heavy equipment would result in increased soil compaction and decreased infiltration, especially where the biological soil crusts exist, and the construction of firebreaks would directly disturb the soil. However, the use of suppression tactics and strategies would limit long-term impacts to soil resources by restricting soil disturbance during fire operations. Rehabilitation efforts following any treatment activity or suppression effort would further limit the extent of long-term impacts to soils.

Low intensity prescribed burns that might occur under Alternative A would have long-term, minor to moderate, localized, beneficial impacts to soil resources from increased nutrients and improved infiltration which would promote new vegetation growth. However, prescribed burns could have short-term, minor, adverse impacts due to pre-burn preparations and the use of fire suppression equipment. Additional mitigation used to limit soil impacts during prescribed burns includes no line building, aerial ignition, use of light-on-the-land vehicles, and use of existing trails. Also, most prescribed burns within the park would occur on fairly level plateaus, thereby limiting the potential for soil erosion.

Cumulative Impacts

Other activities that would affect soils within the park include general maintenance of campsites and trails, visitor use and trampling, and fuel reduction treatments carried out on public or private lands near the park, which can influence the spread of fire into the park. High-intensity wildland fires, resulting from continued fuels buildup, are more probable under the Alternative A and would likely result in more severe impacts to soil stability and productivity. Overall, impacts of actions under Alternative A, combined with impacts of other actions that could affect soils, would result in short- to long-term, minor, adverse cumulative impacts on soil productivity and stability that would be reduced over time with rehabilitation and revegetation of burned or treated areas.

Conclusion

Alternative A would result in short-term, minor to moderate, adverse impacts to soil resources, with long-term, minor to moderate, beneficial impacts. Cumulative effects would be short- to long-term, minor, and adverse.

Because there would be no major, adverse impacts to soils whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's soil resources.

Effects of Alternative B – Proposed Action/Preferred Alternative

Under Alternative B, similar types of adverse effects to soils from wildland fires and prescribed fire would occur, but the effects would be lessened due to implementation of fuel reduction activities and more frequent but less severe fires. As the use of prescribed fire and fuel reduction occur, the resultant reduction in severe fires would help protect soils. Soils may experience short-term disturbance in areas where fuels would be treated due to the presence of staff, vehicles, the removal of slash, and prescribed burning. However, these direct impacts would be very localized, short-term, and minor. Prescribed fire can also lead to sudden increases in nutrient charge to soils from the creation of ash in the immediate

vicinity of the burn. Such increases may provide favorable conditions for many plant species, nitrogen-fixing microbes, and nitrifying bacteria. Water infiltration capability could be enhanced in areas where native herbaceous plants become established after surface fires. Soil and microclimatic conditions following prescribed fire or wildland fire use would favor establishment and growth of native herbaceous and shrub species. Overall, Alternative B would result in short-term, negligible to minor adverse impacts to soils.

Long-term impacts to soils would be largely beneficial due to the lack of intense, unplanned wildland fires and the expected increased productivity and subsequent plant diversity. For several years following low-intensity surface fire, the generally warmer soil temperatures may increase soil microbial activity. In contrast to Alternative A, the increased area in the Suppression FMU and the decrease in area in the Natural FMU would provide for more prescribed fire, thereby reducing fuels and the risk of a high-intensity wildland fire. If wildland fire use fires and prescribed fires are kept to lower intensities and remain on the ground surface, then it is anticipated that long-term benefits to soils and soil chemistry/nutrients would result. Also, with fewer wildland fires, any unplanned need to use heavy equipment on the landscape would be reduced, resulting in a long-term benefit to soils.

Cumulative Impacts

Cumulative impacts under Alternative B include minor compaction from recreation and wilderness users, planned maintenance projects, and some limited vehicle use. However, as fire would be restored to a more natural role over the long term, vehicle use for fuels management and related wildland fire projects would decline, offsetting impacts from non-fire related activities. Overall, impacts of actions under Alternative B, combined with impacts of other actions that could affect soils, would result in short- to long-term, minor, adverse and relatively localized cumulative impacts, with reclamation and revegetation of burned areas providing beneficial effects over time.

Conclusion

Alternative B would result in negligible to minor, adverse effects to soils in the short term, with moderate, beneficial, long-term impacts from the re-establishment of a fire-driven nutrient cycle and increased stability of the soil strata, given increased native herbaceous ground cover and the reduced frequency of unplanned fire suppression activities. Cumulative effects would be localized, short- to long-term, minor, and adverse.

Because there would be no major, adverse impacts to soils whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's soil resources.

Vegetation

Affected Environment

An elevation range from 3,666 feet to 8,726 feet, coupled with topographic complexity and unique geologic substrates creates a diverse flora in Zion. The park includes four life zones: Lower Sonoran, Upper Sonoran, Transition, and Canadian. These life zones consist of low elevation desert shrubland communities with Mojave Desert elements, mid-elevation shrublands and pinyon-juniper woodlands typical of the Colorado Plateau and Great Basin, and montane forests and oak brush shrublands at the park's highest elevations.

Canyons in the park are an important desert oasis, with streams, seeps, wetlands, and hanging gardens. Perennial and ephemeral streams converge into the East and North Forks of the Virgin River, hosting riparian tree species such as the Fremont cottonwood (*Populus fremontii*), Goodings willow (*Salix goodingii*), boxelder (*Acer negundo*), and velvet ash (*Fraxinus velutina*). Seepwillow (*Baccharis emoryi*) and Coyote willow (*Salix exigua*) are common riparian shrubs. A substantial threat to native plant communities within floodplains and increasingly in the uplands (especially in Zion Canyon) is the invasion and dominance of the exotic annual grasses, cheatgrass (*Bromus tectorum*) and ripgut brome (*Bromus diandrus*).

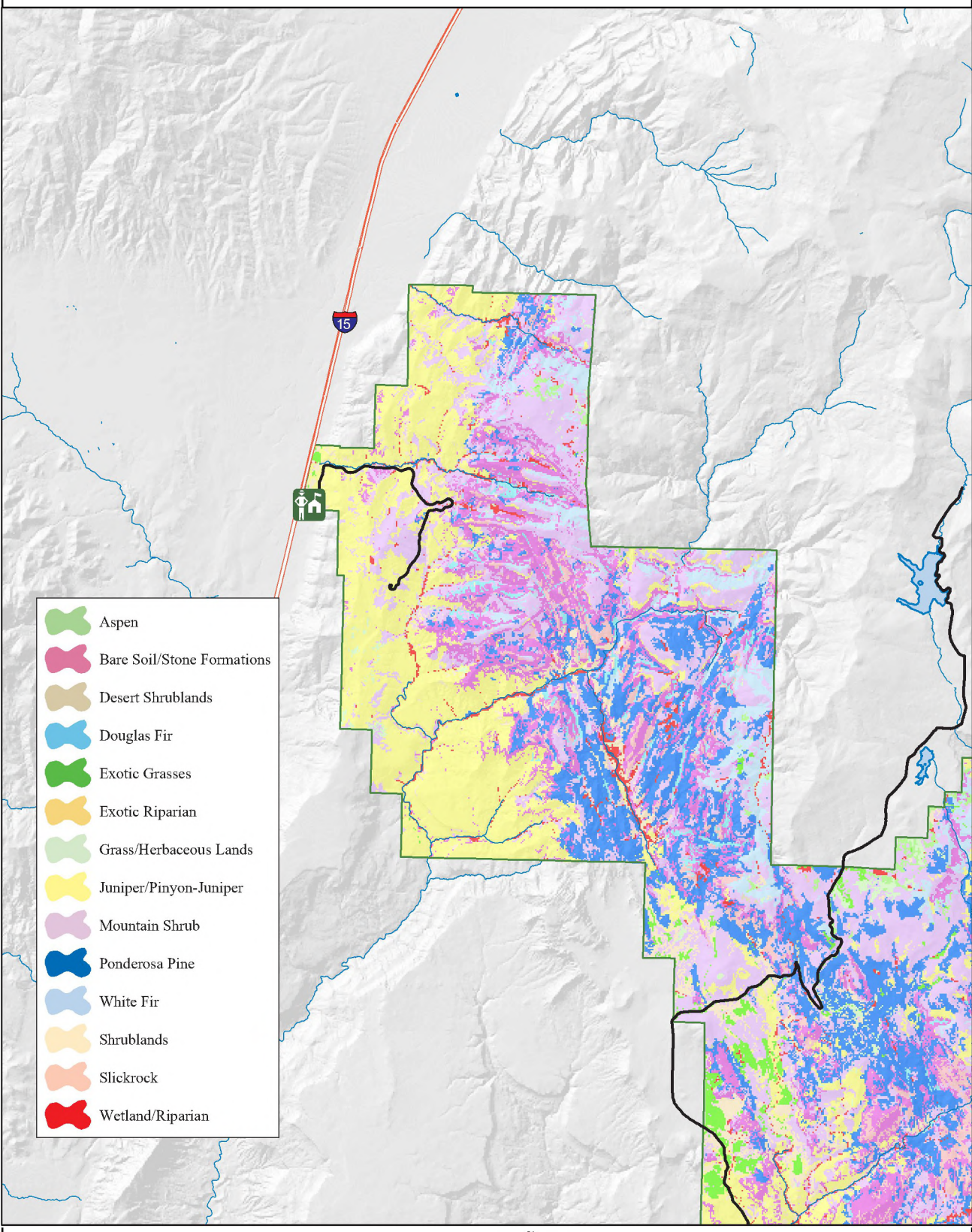
Vegetation in the lower to mid elevations is generally sparse and low in stature due to lack of moisture. Semi-arid desert species, such as blackbrush (*Coleogyne ramosissima*), four-wing saltbush (*Atriplex canescens*) and pockets of mesquite (*Prosopis glandulosa*), are common. Sandy slopes upland from waterways support mostly pinyon pines (*Pinus edulis*, P. *monophylla*), one-seed juniper (*Juniperus osteosperma*), sand and big sagebrush (*Artemesia filifolia* and *A. tridentata*), and rubber rabbitbrush (*Chrysothamnus nauseosa*). Interspersed within these species are pockets of grasses, mainly sand dropseed (*Sporobolus cryptandrus*), mutton grass (*Poa fendleriana*), and the invading non-native red brome (*Bromus rubens*). Red brome is becoming a substantial concern at lower elevations because of its abundance and flammability.

Steep, rocky talus slopes form transitions between floodplains and Navajo sandstone cliffs throughout much of the park. On these sites live oak (*Quercus turbinella*) and silver buffaloberry (*Shepherdia rotundifolia*) are prevalent, along with pinyon and juniper. In the center of the park and extending east are large expanses of Navajo sandstone slickrock and its derived soils. Here, ponderosa pine (*Pinus ponderosa*) becomes more common, along with opportunistic shrubs, such as greenleaf manzanita (*Arctostaphylos patula*) and littleleaf mahogany (*Cercocarpus intricatus*). In mesic canyons and north facing benches, Douglas fir (*Pseudotsuga menziesii*) occurs.

As the elevation increases, semi-arid shrublands transition to more mesic montane vegetation. Ponderosa pine, aspen (*Populus tremuloides*), and white fir (*Abies concolor*) dominate. Tall shrubs consist of gambel oak (*Quercus gambelii*), serviceberry (*Amelanchier utahensis*, A. *alnifolia*), and bigtooth maple (*Acer grandidentatum*).

The vegetation of Zion and the surrounding area was mapped through a project with the U.S. Bureau of Reclamation, The Nature Conservancy (Nature Serve), and the NPS. Table 13 and Map H (North and South) display the major vegetation complexes within Zion delineated by vegetation community. In addition, Table 13 outlines general fire behavior characteristics, native or non-native vegetation, and acreage within the park. The database provides a detailed crosswalk to all U.S. National Vegetation Classification System (NVCS) floristic and physiognomic levels and several other classification systems; however, the data presented here is a combination of the vegetation types grouped together by elevational gradients and dominant species or types of vegetation.

Map H (North): Major Vegetation Complexes



Map Projection: Tranverse Mercator,
UTM Coordinate System, Zone 12,
Datum: NAD 1983

Map produced by Zion National Park,
Resource Management & Research, GIS Program

N
W E
S

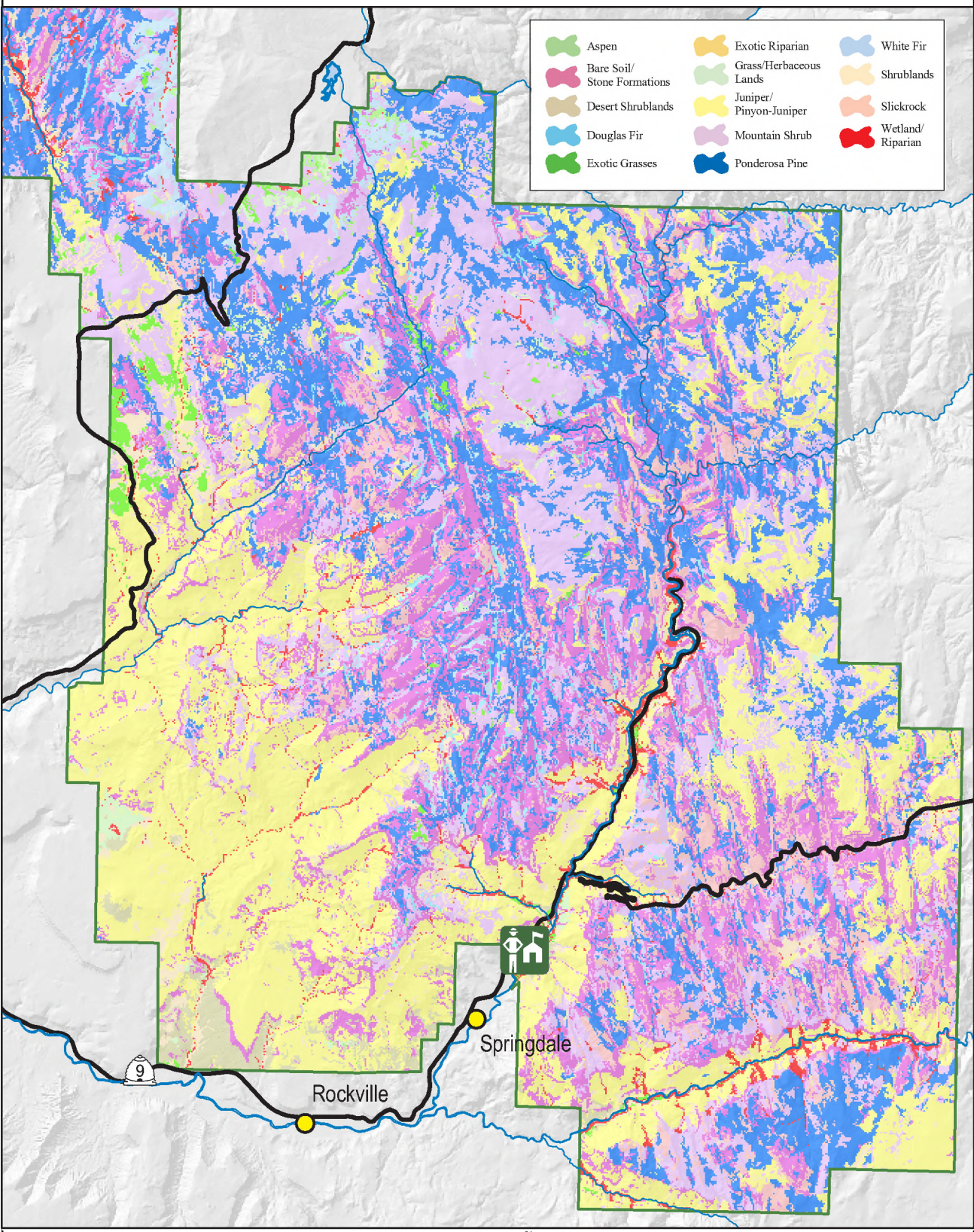
1:144,000

0 Miles 3

The National Park Service does not assume responsibility for information accuracy, precision, or completeness as displayed on this map.

October 2004

Map H (South): Major Vegetation Complexes



Map Projection: Tranverse Mercator,
UTM Coordinate System, Zone 12,
Datum: NAD 1983

Map produced by Zion National Park,
Resource Management & Research, GIS Program

N
W E
S

1:144,000

0 Miles 3

The National Park Service does not assume responsibility for information accuracy, precision, or completeness as displayed on this map.

October 2004

Table 13: Major Vegetation Complexes			
Vegetation Communities[1]	**Fire Behavior Characteristics**	**Native/Non-Native**	**Acreage**
Exotic Grasses • Kentucky bluegrass/smooth brome semi-natural grassland complex • Cheatgrass semi-natural herbaceous alliance • Snowberry/Kentucky bluegrass semi-natural shrubland • Transportation, communications, and utilities • Mixed urban or built-up land • Croplands and pastures • Orchard, groves, vineyards, nurseries, and ornamental horticultural areas • Other agricultural lands • Strip mines, quarries, and gravel pits	High to extreme where fuels are continuous	Non-Native	1,376
Grass/Herbaceous Lands • Galleta grass herbaceous • Sand dropseed Great Basin herbaceous • Dry meadow mixed herbaceous mosaic	Low to moderate	Native	1,144
Wetland/Riparian • Sedge – rush wet meadow herbaceous mosaic • Tinajas (natural water holes/tanks) • Cattail – bullrush emergent wetland complex • Seepwillow shrubland • Coyote willow shrubland alliance • Seasonally flooded shrubland • *Salix ligulifolia*/*Carex utriculata* shrubland • Single leaf ash woodland • Boxelder woodland alliance • Fremont cottonwood woodland complex • Mixed deciduous riparian woodland • Perennial streams • Intermittent streams • Reservoirs • Canals • Stock Ponds	Moderate to high	Native	3,030
Exotic Riparian • Saltcedar (tamarisk) temporarily flooded shrubland • Russian olive semi-natural woodland	High to extreme where fuels are continuous	Non-Native	7
Desert Shrublands • Blackbrush shrubland complex • Nevada ephedra – Fremont's buckwheat badlands sparse vegetation • Nevada ephedra basalt shrubland • Snakeweed – (prickly pear)/galleta grass dwarf-shrubland • Mesquite Colorado Plateau shrubland	Moderate to high where fuels are continuous	Native	1,992
Shrublands • Sand sagebrush Colorado Plateau shrubland • Big sagebrush shrubland complex • Rabbitbrush shrubland complex • Scrub oak – (Utah serviceberry) colluvial shrubland	Moderate to extreme where fuels are continuous	Native	5,205
Slickrock • Dwarf mountain mahagony slickrock sparse vegetation • Ponderosa pine slickrock sparse vegetation	Low	Native	8,635

Table 13: Major Vegetation Complexes			
Vegetation Communities[1]	**Fire Behavior Characteristics**	**Native/Non-Native**	**Acreage**
Mountain Shrub • Black sagebrush dwarf-shrubland complex • Greenleaf manzanita shrubland complex • Greenleaf manzanita – Gambel oak – (Utah serviceberry) shrubland • Gambel oak shrubland alliance • Mixed mountain shrubland • Utah serviceberry shrubland • Mountain mahagony rock pavement sparse vegetation • Gambel oak woodland • Quaking aspen/Gambel oak forest	High to extreme where fuels are continuous	Native	28,859
Aspen • Quaking aspen forest complex	Moderate to high	Native	299
Juniper/Pinyon - Juniper • Juniper/big sagebrush woodland complex • Pinyon pine/juniper woodland complex • Pinyon pine – juniper/Gambel oak woodland complex	High to extreme where fuels are continuous	Native	43,806
Ponderosa Pine • Ponderosa pine/greenleaf manzanita woodland • Ponderosa pine/Gambel oak woodland complex • Ponderosa pine/mixed herbaceous woodland complex • Ponderosa pine forest (closed canopy)	High to extreme where fuels are continuous	Native	25,181
Douglas Fir • Douglas fir forest alliance	High to extreme where fuels are continuous	Native	1,701
White Fir • White fir forest alliance	High to extreme where fuels are continuous	Native	2,868
Bare Soil/Stone Formations • Carmel formation (limestone) • Temple cap (sandstone) • Navajo formation (sandstone) • Kayenta formation (sandstone) • Moenave formation (sandstone) • Chinle formation – petrified forest (shale) • Chinle formation – Shinarump (shale) • Moenkopi formation (conglomerate) • Kaibab formation (limestone) • Basalt talus • Unvegetated volcanic cinders and cinder cones • Slides (fans and slumps) • Gullies and eroded lands • Sand bars and beaches • Volcanic and basalt cliffs • Snags	N/A	N/A	23,921
TOTAL ACRES			**148,024**
[1]adapted from [site USBOR] Fuel Complexes & Continuity			

Invasive Exotic Plant Species

Over 100 non-native plant species occur in Zion; 12 are of priority management for control and eradication. Tamarisk (*Tamarix ramossisima*) and Russian olive (*Eleagnus angustifiolia*) are the primary invasive species along riparian areas. Both non-native tree species are increasing throughout the West and are able to effectively displace native riparian communities, creating monocultures in formerly biologically diverse habitats. Tamarisk in particular alters riparian communities that typically have

moderate fire severity and intensity to a vegetation community type with a high or extreme fire severity and intensity. Zion has actively controlled these species for the past two decades.

In disturbed areas, Scotch thistle (*Onopordum acanthium*), bull thistle (*Cirsium vulgare*), and white top (*Cardaria draba*) are most commonly seen along trails in the front and backcountry. Zion staff work diligently with hundreds of volunteers to control these invasive weeds. Currently, knapweed (*Centaurea* spp.) and yellow starthistle (*Centaurea solstitialis*) occur in small infestations, but are of great potential threat. Known occurrences of non-native species would be controlled each growing season and new populations would be detected as early as possible.

Covering immense areas throughout the Intermountain West, cheatgrass and ripgut brome (*Bromus diandrus*) have also succeeded in Zion, infesting over 8,000 acres. Because these exotic annuals germinate in the fall or winter, they effectively outpace native bunch grasses that emerge weeks or months later. The non-native annual grasses not only use scarce water and nutrients, they also form dense, continuous fuels that cure in the heat of the summer, unlike native species that occur in patchy bunches and "green up" during mid-summer. This creates a fire potential in Zion Canyon where the herbaceous understory is almost entirely cheatgrass and ripgut brome. In addition, an emerging issue is red brome, an invader that is gaining a foothold in the lower elevations of the park where fuels are characteristically very sparse and the native plant communities are intolerant of fire.

Fire management activities can be a useful tool for controlling non-native plant invasions when paired with monitoring and other control treatments. However, activities related to fire suppression or prescribed burning also have great potential to distribute weed seed and aggravate weed problems.

Vegetation Monitoring

Fire management specialists utilize a variety of data to better understand the effects of fire on vegetation. Some data comes directly from monitoring effects of fire management activities on vegetation, while other data displays more general vegetation information. The following list outlines the monitoring and mapping techniques used by Zion fire management specialists. A complete description of these methods can be found in Appendix F.

Fire Effects Vegetation and Fuel Loading Monitoring Program: Monitoring allows resource managers to determine whether or not prescribed fire applications are meeting objectives and, if necessary, to adjust future treatment prescriptions.

Mechanical Treatment Monitoring: Treatments to determine vegetation changes associated with hazard fuel reduction are documented and monitored.

ECODATA Vegetation Monitoring: The methodology is a modified version of the standardized ECODATA protocols used by various agencies in different parts of the country.

Rare Plant Monitoring: Surveys and monitoring are completed prior to and following fire management treatments to document presence or absence of plants across the project areas. A few areas have had some permanent transects installed to monitor rare plant populations.

Vegetation Mapping Plots: Comprehensive mapping project of all vegetation in Zion and surrounding area provides information that can be used to classify and map the vegetation/fuel characteristics of the park. Field validation plots offer the opportunity for long-term vegetation monitoring and ecological change.

Exotic Plant Monitoring: Zion maintains a database of exotic plants containing locations, number of plants, eradication dates and methods, size of treated areas, hours for treatments, herbicide name and amount used, and personnel involved. The purpose of the program is to maintain records of exotic plant locations and effectiveness of control treatments.

Impact Threshold Definitions

Negligible	No native vegetation would be affected, or some individual native plants could be affected as a result of the alternative, but there would be no effect on native species populations. The effects would be on a small scale.
Minor	The alternative would temporarily affect some individual native plants and would also affect a relatively minor portion of that species' population. Mitigation to offset adverse effects could be required and would be effective.
Moderate	The alternative would affect some individual native plants and would also affect a sizeable segment of the species' population over a relatively large area. Mitigation to offset adverse effects could be extensive, but would likely be successful.
Major	The alternative would have a considerable affect on native plant populations and would affect a relatively large area in and outside of the park. Mitigation measures to offset the adverse effects would be required and would be extensive; success of the mitigation measures would not be guaranteed.
Duration	Short-term – recovers in less than three years
	Long-term – requires more than three years to recover
Area of Analysis	Within park boundary

Effects of Alternative A – No Action Alternative

Under Alternative A, vegetation management would allow for, but would not emphasize, wildland fire use and would not focus on building partnerships with neighboring landowners to manage wildland fire for resource benefit across park boundaries. Also, mechanical clearing would be limited to developed areas and herbicide use would not permitted for fire management purposes. The result would be continued fuel buildup in some areas of the park and on adjacent lands, where fuel reduction treatments are not coordinated with NPS efforts. Juniper has invaded lower elevation areas and is now dying off due to drought, creating a fire hazard. Aspens that have not been burned are now older stands that are more susceptible to extreme fires. Ponderosa pine forests have dense understory growth that provides ladder fuels and creates a large fuel load. Where this type of fuel buildup continues, there would be a greater chance of catastrophic wildland fire, especially in the Natural FMU (57% of park under Alternative A), where prescribed fire would be limited and no mechanical or herbicide treatments would be permitted as under current management. In the Boundary FMU, suppression is often selected in order to contain wildland fire use to the park, since wildland fire use cannot leave the unit under the current plans. This also contributes to the buildup of fuels over time.

Zion's vegetation communities would experience varying impacts and reactions to the expected fire regime under Alternative A. Any plant communities that are affected by wildland fire would experience immediate and direct short-term, moderate adverse impacts, depending on the severity and extent of the fire. In the case of a catastrophic event, there would be the potential to lose populations of some species. Over time, there would be a shift to early successional species and a change in the structure and function of the community. In the long-term, beneficial impacts to the overall vegetation community could result, with the creation of a more diverse, open woodland. For example, ponderosa pine is one of the predominant vegetation communities in the park. Fire has historically played an important role in the ponderosa pine forest, maintaining open stand conditions by periodically thinning the understory and providing a mineral seedbed for pine seed germination. With suppression of fire over time, the buildup of

fuels has created fuel ladders that can allow development of a more severe crown fire, decreasing the chance of mature tree survival. A stand-destroying wildland fire would result in an initial herb-shrub stage, and the area would undergo succession over time, with the type of successional species depending on site-specific conditions. If ponderosa pine return, a more even-aged stand would result (Bradley et al. 1992).

Actions to suppress wildland fires also have direct, but short-term adverse impacts on vegetation. Suppression activities that would include creation of fire lines and use of heavy equipment would result in the removal of vegetation and the other impacts to vegetation from trampling, destruction of root systems, and compaction or removal of soils. These short-term, minor to moderate adverse impacts would be mitigated by limiting fire line construction and conducting site rehabilitation.

Another potential adverse impact from wildland fire is the creation of open, disturbed areas that can be invaded by exotic plants. The exposed mineral soil provides a seed bed for exotics, and various species have been rapidly spreading in the general region of the park. Conversely, fire may in some cases help to promote denser growth of native plants on the newly exposed seedbed, which can compete with exotics and preclude exotic plant invasions. Mitigation to control exotics would be implemented.

Fuel reduction activities under Alternative A would have moderate long-term benefits, as well as short-term, minor to moderate direct adverse impacts limited to the target vegetation community. Prescribed burns would have varying effects, depending on the fire resistance of the vegetation community, stand structure, existing fuel loads, burn size and intensity, and post-burn conditions that may favor or hinder site recovery. Effects include mortality of young plants and injury to some adult tree and shrub species. Site recovery would depend on each species' resistance or resilience when exposed to disturbance. For example, ponderosa pine is a fire adapted/resistant species due to its thick bark, high resin content, deep roots, and relatively high and open growth habit. Also, ponderosa pine seedling establishment is favored when fire removes forest floor litter (Bradley et al. 1992). Therefore, a ponderosa pine community would recover relatively quickly from prescribed burns. Conversely, open stands of smaller pinyon-juniper are less fire resistant and would take longer to recover. The community would revert back to grassland and eventually a grass/shrub community would become established. Overall, in the long term, fire-adapted communities (such as ponderosa pine and Douglas fir) would benefit from prescribed fire, since the understory would be thinned, litter converted to nutrients, and initial steps taken to re-establish a natural fire regime. Mitigation measures would be implemented to limit adverse effects of prescribed fire and would include rehabilitation of fire lines and other ground disturbance.

Mechanical clearing under Alternative A would be limited to developed areas only, with no mechanical clearing done in the Natural FMU. Clearing and burning of slash piles would result in short-term, direct, minor adverse impacts to the affected vegetation in the treatment area. Vegetation would experience a minor to moderate, long-term beneficial effect because fire has been a missing natural process in the treated areas. Mitigation measures to limit adverse impacts would be implemented (see Chapter 2, *Mitigation Measures for Alternative A*).

Whenever prescribed burns and mechanical clearing would be used, surveys would be conducted to determine the presence of exotic plant species and to ensure these areas would not be susceptible to invasion by exotics if disturbed. Exotic species would be controlled on a site-by-site basis during project implementation. Burned areas would be seeded only with native seed and only when necessary.

Cumulative Impacts

Cumulative impacts to vegetation would result from the fire management actions described under Alternative A, combined with other actions in and around the park that affect vegetation. These actions

include the fire management activities occurring and planned by other agencies and outside landowners along the park's boundary. Previous and potential future fire suppression has created unwanted fuel buildup outside the park, which contributes to the potential for adverse impacts from wildland fire that could spread into the park. Continued planning for fuel reduction and wildland fire use by all parties would gradually reduce that risk over time and result in indirect beneficial impacts to vegetation communities in the area. However, development of private land outside the park is expected to continue. This would result in ground disturbance and the increased potential of human-caused fire spreading from adjacent land into the park. Exotic plants have also spread throughout the area, and the continued disturbance of land in and outside park boundaries from construction and maintenance activities can contribute to adverse impacts from exotic plant invasion. Other actions that could contribute minor, adverse impacts to vegetation include disease and the removal and disturbance of vegetation by maintenance crews and visitors (trampling). Overall, impacts of actions under Alternative A, combined with impacts of other actions that could affect vegetation, would result in moderate, adverse, cumulative impacts to vegetation.

Conclusion

Alternative A would result in short-term, direct, minor to moderate adverse impacts to vegetation, including higher degrees of plant mortality from high severity fires in or near the park as a result of continued fuel buildup in certain areas, with the potential for moderate impacts in the event of a catastrophic fire. Fuel reduction treatments would result in short-term, minor to moderate, direct adverse impacts to the target community, with long-term, moderate beneficial impacts as the community recovered over time. Mitigation measures would be implemented to rehabilitate burned areas and limit spread of exotics. Cumulative impacts would be moderate and adverse.

Because there would be no major, adverse impacts to vegetation whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant NPS planning documents, there would be no impairment of the park's vegetation.

Effects of Alternative B – Proposed Action/Preferred Alternative

Under Alternative B, several actions would be taken to reduce the potential for extreme wildland fires by implementing more fuel reduction projects (especially mechanical thinning), emphasizing appropriate use of wildland fire use in all areas except the Suppression FMU, and allowing for more partnerships and fuel treatments/wildland fire use across park boundaries with neighboring landowners. The Suppression FMU would increase in size (from 6% to 22% of the park) and aggressive suppression would continue in developed and WUI areas, but prescribed fire would continue and other fuel reduction actions (mechanized handheld, possibly tracked vehicle use) would be implemented where appropriate and approved, in partnership with neighbors. In the Modified FMU, wildland fire use would be permitted to leave the unit, per an approved Wildlife Fire Implementation Plan and following natural fuel breaks rather than jurisdictional boundaries, thereby reducing risks from neighboring lands in the long term. Under this alternative, fewer acres would be located in the Natural FMU (from 57% to 12% of the park), and the lands that were previously limited to very limited prescribed fire or no mechanical or herbicide use would now be in the Modified or Conditional FMUs, where more use of prescribed fire and mechanical thinning, as well as wildland fire use, would proactively reduce fuel loads over a larger area of the park.

Impacts to vegetation from fires under Alternative B would be similar to those described for Alternative A, but with a much reduced chance of catastrophic wildland fire over time, limiting adverse impacts from wildland fires to minor to moderate levels and reducing the extent of effects. The decision to use wildland fire for resource benefit or for fuel reduction, as well as to use prescribed fire, would result in

minor to moderate, short-term adverse effects to plant communities from direct mortality, as well as long-term benefits as a more open overstory and a perennial herbaceous forb/grass understory developed on the site. Over time, more pronounced increases in species richness, diversity, and resiliency would occur, with a tendency toward fire-tolerant plant species across the affected landscape. Fire regimes would be reduced to a lower condition class within the park boundary.

As mentioned in Alternative A, most native plant associations are adapted to the effects of periodic surface fires, and prescribed fire would produce beneficial impacts in these communities. Prescribed fire typically benefits ponderosa pine through reduction in stem density, temporary reduction of understory shrubs (releasing nutrients for the pine), and reduction of ground and ladder forests (protecting ponderosa pine from more severe fires).

Mechanical thinning under Alternative B would include the use of handheld saws, light forestry equipment, chainsaws, and mechanized wheeled or tracked equipment (with the Superintendent's approval), and would be permitted in all units (although limited to restoration, research, and resource protection purposes in the Natural FMU). Impacts to vegetation would be minimized through implementation of mitigation measures, such as using the least damaging tool for the job, and use of light-on-the-land vehicles to minimize crushing and soil compaction.

Herbicide use would be permitted in areas for both exotic control and limited fuel reduction where other measures are not feasible and only to protect important cultural and/or natural resources. Herbicide application would be limited to small areas and would be conducted by certified applicators in accordance with label instructions.

Cumulative Impacts

Cumulative impacts under Alternative B would be similar to Alternative A, but with additional long-term, beneficial impacts from increased fuel reduction and appropriate use of wildland fire across park boundaries. Overall, impacts of actions under Alternative B, combined with impacts of other actions that could affect vegetation, would result in minor to moderate, adverse, cumulative impacts to vegetation.

Conclusion

Alternative B would result in short-term, minor to moderate impacts to vegetation primarily in very localized areas for the most part, with much less chance of higher intensity fires and related higher levels of impacts. Increased prescribed fire and mechanical thinning would reduce fuel load and open up areas previously containing high densities of trees and brush, resulting in long-term benefits from restoring a more natural fire regime and ecological process. Mitigation measures would limit adverse impacts from burning, thinning, and herbicide use. Cumulative impacts would be minor to moderate and adverse.

Because there would be no major, adverse impacts to vegetation whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant NPS planning documents, there would be no impairment of the park's vegetation.

Water Quality and Hydrology

Affected Environment

Zion National Park is located entirely within the basin of the Virgin River and its two primary tributaries, the North Fork and the East Fork. Smaller tributaries, including North Creek, LaVerkin Creek, Shunes

Creek and Taylor Creek, join the Virgin River downstream from the park. Some of the stream flow arises upstream of the park, particularly during floods and spring runoff, but the majority of the base flow comes from numerous springs and seeps that discharge groundwater from the base of the Navajo sandstone. These springs occur in the park (and immediately upstream on the East Fork) where deep canyons have cut through the 2,000-foot thick Navajo sandstone, the primary aquifer in southern Utah. River flow in Zion is currently substantially natural and free flowing. Minor diversions of water occur upstream of the park for irrigation and domestic uses, amounting to about 10 percent of the discharge of the river. No large reservoirs exist that could substantially alter natural floods or low flows.

Water quality conditions in Zion do not vary dramatically from source to source, although individual streams may vary considerably over time, particularly in turbidity and suspended sediment. Springs from the base of the Navajo sandstone are moderately low in dissolved solids (specific conductance near 300 µmhos/cm), while streams draining from higher or lower strata have higher concentrations. Of the primary streams in the park, LaVerkin Creek and North Creek have the highest levels of mineralization (specific conductance near 1000 µmhos/cm), while the North and East Forks of the Virgin River show somewhat lower levels (specific conductance of 600-800 µmhos/cm). The presence of dissolved metals in drinking water in excess of drinking water standards has rarely occurred. Thus, these events appear to be anomalies rather than identifiable problems.

Sediment and turbidity are the most significant water quality characteristics of the rivers and streams in the park. While most streams are relatively clear during periods of low flow, high flows are accompanied by large increases in sediment transport and turbidity. Most of the sediment movement occurs during spring runoff, which may last several weeks, and during very brief runoff events following summer thunderstorms. The total sediment transport of the North Fork of the Virgin River is estimated to be roughly 800,000 tons/year, predominately of sand. Most of this appears to be natural, although it may be increased somewhat by road building and grazing on the watershed.

Limited analysis has indicated that fecal bacteria levels exceed the state standard for full-body contact recreation 20 to 30 percent of the time, with likely sources including livestock and wildlife upstream of the park, recreational activity, and wastewater treatment systems.

According to Standards of Quality for Waters of the State, R317-2, Utah Administrative Code, waters in the park are protected for domestic water supply, secondary contact recreation, cold water fishery and aquatic life, and agriculture and livestock watering. North Creek and Coalpits Wash are protected for non-game fish and aquatic life only. LaVerkin Creek is protected for warm water fish and aquatic life only. In addition, the North and East Forks of the Virgin River are designated as “High Quality Category 2” waters, which provide for non-degradation of existing water quality from new sources of effluent discharge requiring permits.

Impact Threshold Definitions

Negligible	Neither water quality nor hydrology would be affected, or changes would be either non-detectable or, if detected, would have effects that would be considered slight and local.
Minor	Changes in water quality or hydrology would be measurable, although the changes would be small and the effects would be localized. No mitigation measure associated with water quality or hydrology would be necessary.
Moderate	Changes in water quality or hydrology would be measurable, but would be relatively local. Mitigation measures associated with water quality or hydrology would be necessary and the measures would likely succeed.
Major	Changes in water quality or hydrology would be readily measurable, would have substantial consequences, and would be noticed on a regional scale. Mitigation measures would be necessary and their success would not be guaranteed.
Duration	Short-term – would occur within the first year following treatment
	Long-term – would continue more than one year following treatment
Area of Analysis	Within park boundary and downstream drainages

Effects of Alternative A – No Action Alternative

Effects to water resources from Alternative A would depend on the fire incident rate, location and size of fires, and the amount of time needed for suppression. Water flow and turbidity, temperature, and other attributes can be affected by high-severity fire, which would be more likely under Alternative A due to the continued buildup of fuels in the park. If more severe, widespread wildland fires were to occur, physical and chemical changes in the water would result from the heat of the fire, dumping of slurry during suppression, and sedimentation and ash input. Soils that are severely burned do not allow water to infiltrate into the soil (they become "hydrophobic," or water-repellent), which in turn increases run-off that can carry substantial amounts of ash into downstream waterways. In addition, the removal of vegetation as a result of fire or suppression activities, especially riparian vegetation, would remove a sediment buffer, increasing the chance for water quality degradation due to sediment/ash input and associated increases in water temperatures. The amount of runoff would also increase stream or river flows, changing the hydrologic regime and possibly increasing channel erosion in the short-term. Flows from springs could increase locally if the removal of vegetation that would normally use the water from shallow aquifers allows for more water flow; this could be a minor beneficial effect.

Adverse, long-term impacts from fire (either wildland fire use, prescribed fire or catastrophic wildland fire) could be minor to moderate, depending on the location, severity, and duration of the fire. After the fire event, there could be continued loss of soils and sedimentation into streams, which could carry downstream. The watershed may take several years to recover following a substantial wildland fire.

Cumulative Effects

Cumulative impacts to water quality would result from continued existing practices at the park, plus the additional wildland fire use in the surrounding area, as well as effects from other sources of point and non-point pollutants from surrounding communities and ranches. There are no substantial sources of industrial pollution in or near park waterways. Fire-related activities would involve the same types of effects described in the analysis above, but would be intensified if fire spread and affected more of the Virgin River watershed. With recovery of the area surrounding the river, adverse cumulative impacts to water quality would be reduced. Overall, impacts of actions described under Alternative A, added to the impacts of other actions affecting water quality, would result in minor cumulative adverse impacts to water quality in park and downstream waters.

Conclusion

Alternative A would result in short-term, minor to moderate, adverse impacts to water quality because of the increased chance of wildland fire, resulting in increased runoff of soil and ash into streams, an increase in stream temperature, higher temporary nutrient loading, and possible increased channel erosion with locally long-term, minor to moderate adverse, effects expected in case of more extreme and/or widespread fire. Cumulative effects would be short- to long-term, minor, and adverse.

Because there would be no major, adverse impacts to water and aquatic resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's water and aquatic resources.

Effects of Alternative B – Proposed Action/Preferred Alternative

Under Alternative B, impacts to water quality and hydrology would be similar to those expected under Alternative A, but with a reduced possibility of more severe adverse impacts since there would be a reduced possibility of more extensive or catastrophic wildland fire. Short-term, adverse impacts from loss of vegetation due to wildland fire use and/or prescribed burns in areas bordering park waterways would be negligible to minor, with limited effects due to the more controlled nature of the burn. Long-term, moderate beneficial impacts would be expected following fire or thinning, as denser ground cover would regrow and bind soils, providing erosion control and preventing runoff to waterways.

Adverse impacts from mechanical clearing may include soil disturbance and possible minor fuel spills, but these would be very localized, short-term, and negligible. Use of light-on-the-land vehicles and proper spill prevention and cleanup would minimize impacts. As described under mitigation for this alternative, any herbicides used in or near riparian areas or waterways would be applied according to label restrictions, and buffers would be maintained to ensure that chemicals did not enter park drainages. Additional mitigation measures to prevent or reduce adverse impacts to water quality can be found in Chapter 2, *Mitigation Measures for Alternative B.*

Cumulative Effects

Cumulative impacts under Alternative B would be similar to those described under Alternative A, but reduced in intensity and duration since fuels reduction activities and use of controlled, lower intensity fires would help limit extensive burns that could spread beyond the monument boundary and affect more of the Virgin watershed or create more severe erosion and sedimentation. Overall, impacts of actions under Alternative B, combined with the impacts of other actions that could affect water quality, would result in short-term, negligible to minor adverse impacts to water quality in park and downstream waters, with long-term, beneficial impacts due to the recovery of streamside vegetation and the gradual increase in pioneer ground cover in areas treated.

Conclusion

Alternative B would result in short- to long-term, negligible to minor, more localized adverse impacts to water quality. Long-term, moderate beneficial effects would result because of the reduced area that would be affected by extensive wildland fires, the lower fire potential, and the controlled and limited locations of prescribed burns that could result in a thick regrowth that limits erosion and sedimentation. Cumulative effects would be short-term, negligible to minor and adverse, with long-term benefits.

Because there would be no major, adverse impacts to water and aquatic resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's water and aquatic resources.

Wetlands

Affected Environment

NPS Director's Order 77-1 provides guidelines for the protection of wetlands within NPS units. It states a policy of no net loss of wetlands and provides a process for evaluating actions that have a potential to have adverse effects on wetlands.

Wetlands occur in the park along river margins and floodplains, and as isolated wetlands associated with springs, seeps, and small impoundments. The area of the park that consists of wetlands is very small; 191 acres have been mapped, or about 0.1 percent (USDI, FWS, 2000). Of this about half are palustrine (marshy or with standing water) and half are associated with rivers. About 6 percent are classified as saturated or semi-permanently flooded, 4 percent are seasonally flooded, and 89 percent are intermittently or temporarily flooded.

The biological importance of wetlands far exceeds their land coverage because the availability of water greatly enhances their productivity and biological diversity. In wetlands along the rivers, bands of horsetail (*Equisetum sp.*), sedge (*Carex sp.*), bullrush (*Juncus sp.*), coyote willow, and seep willow occur, with an overstory that can include Fremont cottonwood, velvet ash, and box elder. Some small backwaters can also support small stands of cattails (*Typha sp.*). Under natural conditions fires are rare in these wetlands, which are not generally adapted to fire. Where human activity has introduced fire or non-native plants that promote fire have invaded, the result can be an increase in mortality among trees of all age classes. Plants that grow in the wettest areas and have growing points below ground (such as horsetail, sedge, bullrush, and willow) will often survive fire and sprout vigorously.

Marshy wetlands occur at springs, seeps, hanging gardens, tinajas (rock catchments), stockponds, and other small impoundments. They can support a variety of species, including all of those mentioned above for riparian wetlands, although the overstory canopy of trees is usually much smaller, if present at all. Other plants commonly found at springs, seeps and hanging gardens where permanent water is present include monkey-flower (*Mimulus sp*.) and columbine (*Aquilegia sp.*). Plants near most stockponds and other impoundments tend to grade rapidly into upland shrub and grass vegetation due to the very brief period that they typically hold water. The vegetation response to fire is variable in these wetland environments. Very wet sites are not generally prone to fire, while drier sites that include upland vegetation tend to have fire frequencies and responses similar to the surrounding vegetation.

Impact Threshold Definitions

Negligible	Wetlands would not be affected or the effects to the resource would be below or at the lower levels of detection.
Minor	The effects to wetlands would be detectable and relatively small in terms of area and the nature of the change.
Moderate	The effects to wetlands would be readily apparent, including effect to wetland vegetation.
Major	Effects to wetlands would be observable over a relatively large area. The character of the wetland would be changed so that the functions typically provided by the wetland would be substantially changed.
Duration	Short-term – recovers in less than one year
	Long-term – requires more than one year to recover
Area of Analysis	Within park boundary and immediate downstream area

Effects of Alternative A – No Action Alternative

Under Alternative A, an increased potential for wildland fire would exist due to the increasing fuel loading in the park. Such fire, and suppression activities associated with any fire, would result in loss of vegetation, which could include loss of wetland vegetation along the Virgin River and its tributaries, since there would be no pre-planning for these fires that could provide for avoidance of streamside wetland vegetation. Such loss could affect the functions and values of these wetlands, reducing their capacity for nutrient cycling, buffering of floods, and providing habitat. The extent of impacts would depend on the severity, location, and area of the fire. Burned areas would eventually recover, and reseeding of wetland areas would be a priority if they were affected by fire. Overall, Alternative A would result in minor direct and indirect, adverse short-term impacts to wetlands. If lower-intensity wildland fires occurred, longer term, localized beneficial impacts would result from the release of nutrients and subsequent mineral cycling within the wetland community. However, a large scale, high-intensity wildland fire could result in long-term, moderate impacts due to the potential for complete loss of wetland vegetation.

Cumulative Effects

Cumulative effects to wetlands would result from other disturbances from park maintenance, visitor use and trampling, upstream releases, and drought. These actions could cause changes in wetlands due to changes in vegetation and water availability. Visitor use in and near wetland habitat would result in trampling of vegetation and soil compaction and erosion. Prescribed fire treatments and management of wildland fires for resource benefit, when combined with these other activities, would result in long-term, negligible or minor cumulative impacts. Overall, impacts of actions under Alternative A, combined with impacts of other actions that could affect wetlands, would result in minor to moderate, adverse, cumulative effects to wetlands.

Conclusion

Alternative A would result in short-term, minor, direct and indirect adverse impacts to wetlands. Long-term effects would be minor and beneficial as a result of a lower-intensity burn, but could be moderate and adverse to all wetland systems following higher severity fires. Cumulative effects would be generally long-term, minor to moderate, and adverse.

Because there would be no major, adverse impacts to wetland resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General

Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's wetland resources or values.

Effects of Alternative B – Proposed Action/Preferred Alternative

Under Alternative B, the use of wildland fire and fuels reduction would occur, resulting in less chance of a widespread, high-intensity wildland fire along the Virgin River and its tributaries. Manual and mechanical thinning could be planned in advance, and the riparian wetland areas that are not connected to areas of heavy fuel loads would be avoided during prescribed burns. The cutting of vegetation and presence of work crews would have negligible, short-term, localized adverse impacts to wetland functions, but many of these areas would be avoided altogether. Slash piles would not be burned in wetland areas, so these activities would not be expected to have any impacts on wetlands. Use of herbicides would be considered in some riparian areas that could include riparian wetlands; however, they would only be used in areas when no other means of fuel reduction would be effective. Also, as described under mitigation for this alternative, any herbicides used in or near wetlands would be applied according to label restrictions. Prescribed burns in or upgradient of wetlands could have some long-term, minor beneficial effects on wetlands through the release of nutrients and resultant mineral cycling.

Cumulative Effects

Cumulative impacts would be similar to those described for Alternative A, but with negligible to minor adverse impacts since wetlands would be less likely to be affected by more widespread fires. Long-term, beneficial impacts would result as natural vegetation is restored around naturally occurring wetlands. Overall, impacts of actions under Alternative B, combined with impacts of other actions that could affect wetlands, would result in negligible, adverse, cumulative impacts to wetlands.

Conclusion

Alternative B would result in short-term, negligible, adverse impacts to wetland functions, and minor beneficial effects to wetlands from the release of nutrients. Cumulative impacts would be negligible and adverse.

Because there would be no major, adverse impacts to wetlands whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's wetland resources or values.

Natural Soundscapes

Affected Environment

Natural soundscapes are comprised of the natural sound conditions in a park that exist in the absence of any human-produced noises. These conditions are actually composed of many natural sounds, near and far, which often are heard as a composite, not individually. Natural sound conditions include the sounds of running water, blowing wind, chirping birds, and many other sounds found in nature. The opportunity to experience Zion's natural soundscape unimpaired by the sounds of human civilization is an important part of the overall visitor experience, especially as it contributes to the solitude and wilderness experience that is integral to much of the park.

Acoustic data has been collected in Zion over the years. The most recent and most comprehensive data collection effort was by Wyle Laboratories (Hobbs and Downing, 2003), which collected acoustic data from October 2000 to November 2001 at 13 sites throughout the park. Data was collected during spring, summer, and fall at 12 sites and during all four seasons at one site. The data suggests that Zion is a quiet soundscape. Little variation in the soundscape was observed across the park, during the day, and throughout the year.

Human-generated noise in the park is predominantly from vehicle traffic, aircraft overflights, and maintenance and administrative activities (including fire management activities). Frontcountry areas near campgrounds, Zion Lodge, and roads often have higher levels of noise levels. Mechanical noises (such as those produced by aircraft, chainsaws, or fire pumps) can drown out these natural sounds on a temporary basis.

Impact Threshold Definitions

Negligible	Frontcountry High and Low, Transition – Noise created by fire management activities may be present during the daylight hours, but would rarely be audible between sunset and sunrise.
	Primitive, Pristine, Research Natural Area (RNA) – Natural sounds predominate. Noise created by fire management activities is rarely audible. When noise is present, it is at low levels and occurs for only short durations in a small geographic area. Visitors almost always have the opportunity to experience the natural soundscape free from noise created by fire management activities.
Minor	Frontcountry High and Low, Transition – Noise created by fire management activities may predominate during the daylight hours, but the majority of the time the noise is at low levels, and is only rarely at greater than medium levels. Noise created by fire management activities is rarely audible between sunset and sunrise.
	Primitive, Pristine, RNA – Natural sounds usually predominate. Noise created by fire management activities is infrequent, and occurs for only short durations in most of the area. Visitors almost always have the opportunity to experience the natural soundscape free from noise created by fire management activities most of the time in the majority of the area.
Moderate	Frontcountry High and Low, Transition – Noise created by fire management activities predominates during the daylight hours, but only at medium or lower levels a majority of the time. Localized areas may experience noise at medium to high levels half of the daylight hours. Noise created by fire management activities is occasionally audible between sunset and sunrise.
	Primitive, Pristine, RNA – Noise created by fire management activities is present infrequently to occasionally, at low to medium levels and durations. Portions of these zones within 0.5-mile of the Frontcountry High, Low or Transition Zones often experience noise at low or medium levels and durations. Noise created by fire management activities is occasionally audible between sunset and sunrise.
Major	Frontcountry High and Low, Transition – Noise created by fire management activities predominates during daylight hours, and is at greater than medium levels a majority of the time that noise is present. Large areas may experience noise at medium to high levels during the majority of the daylight hours. This noise is often audible between sunset and sunrise.
	Primitive, Pristine, RNA – Natural sounds are commonly masked by noise created by fire management activities at low or greater levels for extended periods of time. Portions of the zones within 0.5-mile of the Frontcountry High, Low or Transition Zones often experience noise at medium levels and durations, and noise levels in these areas occasionally are high. Noise created by fire management activities is frequently audible between sunset and sunrise.
Duration	Short-term – effects extend only through the duration of the proposed project
	Long-term – effects extend beyond the period of the proposed project
Area of Analysis	Within park boundary

Effects of Alternative A – No Action Alternative

The ambient noise levels in the park ranges from noise levels equivalent to remote sites or a quiet house at midnight (approximately 20 A-weighted decibels (dBA)) to frontcountry camping or a developed site (approximately 40 dBA). The use of fire suppression equipment, including fire pumps, helicopters, dozers, or other soil moving heavy equipment, and use of mechanized hand tools, would increase noise levels in the vicinity of the treatment area. Most of the equipment used for fire suppression or vegetation removal ranges in noise level from 88 dBA for mowers to 125 dBA for chainsaws. This equipment would be used for very short durations and in limited areas. Also, associated sound would dissipate quickly (approximately half the noise level per doubling of distance), and variations in vegetation and topography would also minimize sound impacts with distance. The effects of Alternative A on natural soundscapes would therefore be short-term, minor, localized, and adverse due to noise from wildland fire use, prescribed burning activities, and fire suppression activities.

Cumulative Effects

Cumulative effects to soundscapes would result from actions described under Alternative A, plus other disturbances from park maintenance, commercial helicopter flights over the park, motorized vehicle use in and around the park and increased recreational and private development near the park. These actions can cause sound levels in the park to rise, but in limited areas for short periods that rarely impact visitor's enjoyment of park. Overall, impacts of actions under Alternative A, combined with other actions that could affect soundscapes, would result in minor, adverse cumulative effects to park soundscapes.

Conclusion

Alternative A would result in localized, short-term, minor adverse impacts on natural soundscapes due to noise from wildland fire use, prescribed burning activities, and fire suppression activities, including noise from helicopters, mechanical equipment, and vehicle use. Cumulative effects would be to be short-term, minor and adverse, but localized.

Because there would be no major, adverse impacts to natural soundscapes whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other National Park Service planning documents, there would be no impairment of natural soundscapes as a result of the implementation of Alternative A.

Effects of Alternative B – Proposed Action/Preferred Alternative

Noise from natural fire is considered a natural sound. The activities associated with prescribed burning and mechanical fuel reduction would involve the use of chainsaws for several days or weeks in specific locations. Under Alternative B, there would be increased use of prescribed fire in the interior of the park, which would increase the potential for noise impacts to visitors using the backcountry. However, these impacts would be managed by limiting the scope, area, and timing of mechanical equipment used to meet essential fire management requirements. The use of aircraft and helicopters for fire management and suppression activities would impact noise levels throughout the park, but the park would explore options for the use of quiet aircraft technologies to mitigate these impacts. Noise from wildland fire use and prescribed burning, including preparation, would have minor, short-term, site-specific adverse impacts to natural soundscapes. Mechanical fuel reduction would have minor to moderate, short-term, site-specific adverse impacts.

Cumulative Effects

Cumulative effects to soundscapes as a result of actions described under Alternative B, plus other disturbances from park maintenance, commercial helicopter flights over the park, motorized vehicle use in and around the park, and increased recreational and private development near the park would be short-term, minor, localized, and adverse. These actions would cause sound levels in the park to rise, but in limited areas for short periods that would rarely impact enjoyment of the park during the entire duration of a visit. Overall, impacts of actions under Alternative B, combined with other actions that could affect soundscapes, would result in minor, adverse, cumulative effects to park soundscapes.

Conclusion

Alternative B would result in localized, short-term, minor to moderate, adverse impacts on natural soundscapes due to the use of fire suppression and mechanical removal equipment, including helicopters, chainsaws, and fire vehicles. Cumulative effects would be localized, short-term, minor and adverse.

Because there would be no major, adverse impacts to natural soundscapes whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other National Park Service planning documents, there would be no impairment to natural soundscapes.

Wilderness

Affected Environment

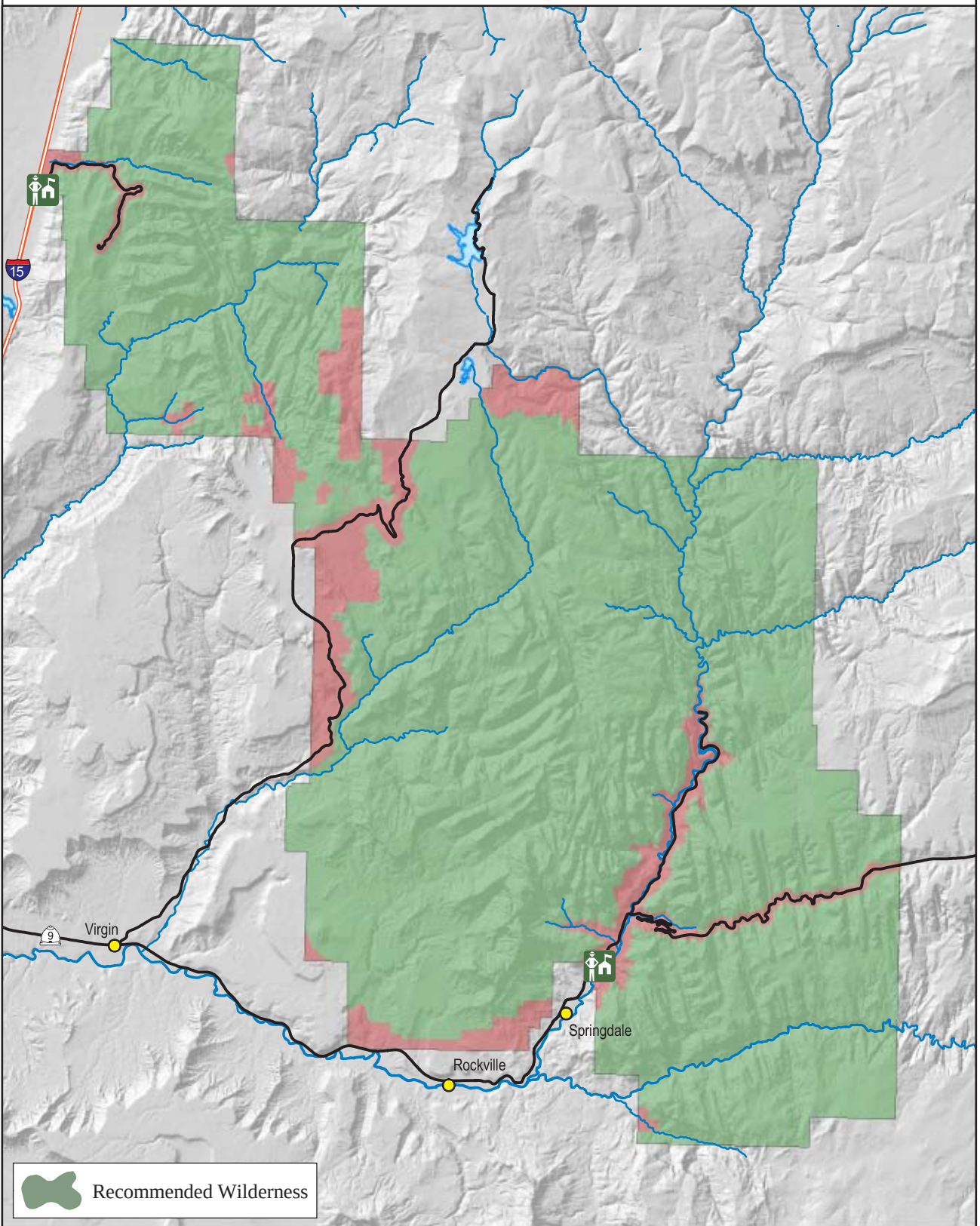
In 1974, approximately 131,000 acres of Zion were recommended to Congress for formal wilderness designation (Refer to Map I). This includes potential wilderness (inholdings, private water diversions) as well as recommended wilderness. While not yet legislatively designated, this recommended wilderness is managed as wilderness in accordance with NPS Management Polices (USDI, NPS, 2001c). These areas provide visitors an opportunity to experience Zion's natural soundscape unimpaired by the sounds of human civilization.

The 1964 Wilderness Act defined wilderness as "an area where the earth and its community of life are untrammeled by man." In addition, the act states that "except as necessary to meet the minimum requirements for the administration of the area for the purposes of this act, there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area." The act also contains a special provision allowing for the use of aircraft in the control of fire.

All fire management activities affecting wilderness would be consistent with the minimum requirement concept. This concept is a documented process used to determine if administrative activities affecting wilderness resources or the visitor experience are necessary and how to minimize impacts. The minimum requirement concept would be applied as a two-step process that determines (1) whether or not the proposed fire management action is appropriate or necessary for administration of the area as wilderness and does not pose a significant impact to wilderness resources and character; and (2) the techniques and type of equipment needed to ensure that impact to wilderness resources and character is minimized.

Under ideal conditions, natural fire should be considered a fundamental component of the wilderness environment. Natural processes would be allowed to continue in these areas, as much as possible, to shape and control wilderness ecosystems.

Map I: Recommended Wilderness



Map Projection: Tranverse Mercator,
UTM Coordinate System, Zone 12,
Datum: NAD 1983

Map produced by Zion National Park,
Resource Management & Research, GIS Program

N
W E
S

1:210,000

0 Miles 5

The National Park Service does not assume responsibility for information accuracy, precision, or completeness as displayed on this map.

October 2004

Impact Threshold Definitions

Negligible	A change in the wilderness character could occur, but it would be so small that it would not be of any measurable or perceptible consequence.
Minor	A change in the wilderness character and associated values would occur, but it would be small and, if measurable, would be highly localized.
Moderate	A change in the wilderness character and associated values would occur. It would be measurable but localized.
Major	A noticeable change in the wilderness character and associated values would occur. It would be measurable and would have a substantial or possibly permanent consequence.
Duration	Short-term – effects would extend only through the duration of the proposed project
	Long-term – effects would extend beyond the period of the proposed project
Area of Analysis	Within park boundary

Effects of Alternative A – No Action Alternative

Under this alternative, fuels would continue to build up, increasing the potential for more catastrophic wildland fire. In the event of a wildland fire, adverse effects on wilderness resources could be extensive, depending on the size and intensity of the burn and the level of suppression efforts. Fire damage to large tracts of land in the proposed wilderness area would adversely affect the visual character, soils, vegetation, wildlife, and would degrade the air quality. In addition, fire suppression efforts would adversely affect soil resources and disrupt the natural quiet from human presence, use of aircraft, and the use of mechanized hand tools. All wildland fires within wilderness would be effectively managed considering wilderness resource values while providing for public and firefighter safety using the full range of strategic and tactical options. Wildland fire management response would include the application of minimum impact suppression techniques and minimum tool requirement techniques. With the application of the minimum tool analysis, Alternative A would have long-term, direct, minor to moderate, adverse impacts on wilderness resources.

Cumulative Effects

Cumulative effects to wilderness would occur as a result of actions described under Alternative A, plus other disturbances from park maintenance, commercial helicopter flights over the park, and increased recreational and private development near the park. Also, the continued build-up of fuel under this alternative, in combination with high fuel loads on adjacent property, would increase the potential for wildland fire to spread within and across park boundaries. Firefighter presence in wilderness and prescribed fires would have a negligible to minor, short-term adverse cumulative effect. Aircraft overflights associated with fire management activities and other administrative and commercial uses may temporarily detract from user experience. Overall, impacts of actions under Alternative A, combined with impacts of other actions that could affect wilderness, would result in long-term, minor to moderate, adverse cumulative impacts to wilderness values in the park.

Conclusion

Alternative A would result in minor to moderate, short-term, direct, adverse impacts on wilderness values due to the risk of a catastrophic fire and the increased human presence required to support fire suppression efforts in wilderness areas. Cumulative effects would be long-term, minor to moderate, and adverse. Analysis of minimum tool requirements would be used in all wilderness areas to keep adverse impacts to minimal levels.

Because there would be no major, adverse impacts to proposed wilderness whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's proposed wilderness resources or values.

Effects of Alternative B – Proposed Action/Preferred Alternative

Under Alternative B, fuels reduction and wildland fire use would be conducted within proposed wilderness. The presence of work crews, fuels reduction activities (such as thinning and clearing vegetation), and the use of power tools (such as chainsaws and brush cutters) could have short-term, minor impacts to wilderness values and resources, such as wildlife and natural quiet. Use of mechanized tools would be determined based on the outcome of a minimum tool analysis. Management activities associated with this alternative would result in short-term, minor impacts because work crews would only be present for a brief period of time, affected areas would be small, and implementation of mitigation measures would help ensure rapid recovery of the areas' soils and vegetation.

The Minimum Requirement Analysis is a two-part process. Part A helps determine whether or not the proposed management action is appropriate or necessary for administration of the area as wilderness, and does not pose a significant impact to wilderness resources and character. Part B describes alternatives for the proposed action in detail, and evaluates each in order to determine the techniques and/or types of tools and equipment (minimum tool) needed to ensure that overall impacts to wilderness resources and character are minimized. The Minimum Requirement Concept is not intended to limit choices. It challenges managers to examine every planned management action to determine if it is appropriate and necessary in wilderness and to choose the best alternative that would least impact unique wilderness resources and character. The purpose and philosophy of wilderness must be considered when evaluating alternatives. Since the majority of Zion is located in proposed wilderness, the Minimum Requirement Analysis would be used when planning fire management actions in the park.

Impacts to wilderness character and values over the long term would be beneficial and moderate in intensity as fire is restored to areas of the park and the wilderness returns to a more natural range of variability in regards to fire. Fires of mixed severity would be more typical of the historic fire regime and would add to the wilderness character being shaped and maintained by natural disturbance events such as fire.

Cumulative Effects

Implementation of the proposed action would, in the short-term, continue the cumulative, minor adverse effects currently resulting from human activities in the proposed wilderness areas. However, the plan provides for long-term, beneficial effects to wilderness through the reduced potential for wildland fire and associated fire-suppression activities. Along with the presence of backcountry users, firefighter presence on wildland and prescribed fires would have a negligible to minor, short-term adverse cumulative effect. Aircraft overflights associated with fire management activities and other administrative and commercial uses may temporarily detract from user experience. Reasonably foreseeable future actions would be anticipated to contribute minor to moderate cumulative effects on wilderness character in the long term, as fire is restored as a natural disturbance event across the landscape and increasingly offsets effects associated with non-fire related activities. Overall, impacts of actions described under Alternative B, combined with impacts of other actions that could affect wilderness, would result in negligible to minor, short-term, adverse, cumulative impacts and minor to moderate long-term beneficial effects.

Conclusion

Alternative B would result in short-term, negligible to minor, adverse impacts to wilderness values due to the use of mechanized tools, the presence of work crews, and the additional noise. The effects to wilderness character would be moderate and beneficial due to the reduction in fuel loads, which reduces the risk of catastrophic fire. Cumulative effects would range from negligible to minor and adverse, to long-term, minor to moderate, and beneficial. Analysis of minimum tool requirements would be used in all wilderness areas to keep adverse impacts to minimal levels.

Because there would be no major, adverse impacts to wilderness whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's wilderness resources or values.

Wildlife

Affected Environment

The diverse vegetation communities within Zion support a variety of wildlife species. Zion is home to 6 species of amphibians, 28 species of reptiles, 79 mammal species, 289 bird species, and 7 fish species. Many species of birds and some mammal species, such as bats, are migratory. Consequently, the number of species and the size of populations vary considerably from season to season. Wildlife species and their habitats are outlined in Appendices G and H. Some habitats have evolved under the influence of fire (ponderosa pine forests) while other habitats have not (desert shrub communities).

Impact Threshold Definitions

Negligible	Wildlife would not be affected or the effects would be at or below the level of detection and the changes would be so slight that they would not be of any measurable or perceptible consequence to the wildlife species' population.
Minor	Effects to wildlife would be detectable, although the effects would be localized, small, and of little consequence to the species' population. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Effects to wildlife would be readily detectable, localized, and with consequences at the population level. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.
Major	Effects to wildlife would be obvious and would have substantial consequences to wildlife populations in the region. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.
Duration	Short-term – recovers in less than one year
	Long-term – requires more than one year to recover
Area of Analysis	With park boundary

Effects of Alternative A – No Action Alternative

Impacts to wildlife under Alternative A may be direct, as in mutilation or injury from fire or fire treatment projects, but most impacts would be indirect and related to the effects on vegetation from fire activities. Fire can create, destroy, or enhance wildlife habitat, causing changes in the subsequent abundance and occurrence of animal species on a burned area. The nature and extent of impacts to wildlife would

depend on the fire intensity, duration, frequency, location, extent, season, site, fuels, and soils present (Bradley et al. 1992).

Under Alternative A, there would be the increased chance of more extreme wildland fire due to the continuation of fuel buildup in certain areas of the park, with subsequent effects on vegetation and wildlife habitat (see *Vegetation* section for additional details). Short-term impacts from wildland fires, wildland fire use, and suppression activities would range from negligible to moderate for wildlife species present, depending on the season, magnitude and extent of fire, and intensity of suppression effort. Some small mammals (e.g., mice, shrews) and birds may be temporarily eliminated from severely burned areas due to the elimination of habitat (nest sites, surface cover) and food. Some mortality of less mobile species or nestlings may occur. However, many of these species would eventually benefit from the results of fire due to the openings created and the new undergrowth of forbs and grasses that would regenerate on burned sites.

Some wildlife species prefer older age stands or late successional woodlands (e.g., porcupines, tree squirrels). In time, any woods that are not burned and continue to exist as forests would benefit these animals. Fire may adversely affect these species, causing them to move to other, more suitable habitats within the park, resulting in short-term, minor impacts only.

Amphibians, would be generally unaffected by fire because of the wet nature of their habitat. Reptiles (lizard, snakes) may experience short-term, minor to moderate adverse impacts due to reduction in ground cover and food, with some direct mortality possible for less mobile species. However, long-term, moderate benefits would result from creation of a more open canopy and the eventual regeneration of a forb/grass ground cover that provides food and cover for these species.

Fire management activities would also have similar effects on wildlife, with some short-term, adverse effects, but generally long-term benefits for many animals. Areas targeted for prescribed fire would be planned primarily during non-breeding seasons, and prescribed fires would be less intense and/or widespread than potential wildland fires. Short-term impacts to some wildlife species include negligible to minor disturbance from the presence of humans and equipment during prescribed fire. Small mammal cover would be exposed over localized areas, but would eventually regrow as lusher cover, which can benefit predator species. Sprouting of canopy species and regrowth of grasses, forbs, and shrubs would generally occur within one to two growing seasons and would moderately enhance habitat conditions for many species of wildlife. Again, those species that are more dependent on denser, mature woodlands would be displaced.

Mechanical clearing under Alternative A would be limited to more developed areas and WUI areas, where wildlife may also be limited, localized, and more adapted to disturbance. The noise and disturbance from use of chainsaws and burn piles would cause minor adverse impacts.

Mitigation measures would be implemented during prescribed fires or mechanical clearing to reduce adverse impacts to wildlife. These measures include timing prescribed fires or thinning operations to avoid key breeding seasons, ensuring that prescribed fire allows for low intensity surface burns, providing adequate cover and travel corridors, and leaving important snags or logs in place.

Cumulative Impacts

Cumulative impacts to park wildlife would arise from fire and fire management in and around the park, as well as other past, present, and future actions. Such actions include fires that occur on neighboring lands and actions related to existing FMPs that other public agencies have implemented, which would have similar effects to park wildlife as described above. The past history of suppressing wildland fires in the

general region has created more fuel loading, which can lead to more catastrophic fires without the increase in fuel reduction activities that have begun to be implemented.

Other actions affecting wildlife in the park and surrounding areas include disturbance from visitors, residents, hunting, disease (e.g., chronic wasting disease in deer and elk), reduction of habitat due to increased construction, maintenance activities, and noise-related impacts from vehicles and aircraft. Helicopter use over the park for maintenance (once per year) and for search and rescue (approximately 12 times per year) can cause very short-term but intense disruption to wildlife on a local basis. Commercial aircraft and air tours also can cause flight response or disturbance of breeding if the craft approaches close enough to wildlife areas. Overall, impacts of actions described under Alternative A, combined with impacts of other actions that could affect wildlife, would result in moderate, adverse, cumulative impacts to wildlife species.

Conclusion

Alternative A would generally result in minor to moderate adverse impacts to wildlife and wildlife habitat, with short-term adverse impacts giving way to longer-term benefits for some species in areas that have burned but recover with new regrowth and a more open canopy. Cumulative impacts would be moderate and adverse.

Because there would be no major, adverse impacts to wildlife whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant NPS planning documents, there would be no impairment of the park's wildlife.

Effects of Alternative B – Proposed Action/Preferred Alternative

Alternative B would result in similar impacts to wildlife as described for Alternative A. However, because of the emphasis on the use of fire to restore the natural role of fire in the park, habitat diversity would eventually increase and more natural ecological conditions would prevail. Species that would benefit from fire would include those that forage for insects in recently burned stands (e.g., woodpeckers); those that prey on mice, voles, and other small mammals that would thrive on newly established herbaceous cover (e.g., foxes, coyotes); and those that eat fresh browse (deer, elk). As with Alternative A, species that prefer the older, even-aged stands would experience displacement to more suitable habitat, resulting in a short-term, minor adverse impact.

Overall, Alternative B would provide long-term moderate beneficial impacts. Habitat conditions after prescribed fire, clearing, or wildland fire use would be expected to gradually improve. Prescribed fires would result in improved forage vigor by increasing sunlight and releasing nutrients. Snags would be left for wildlife use where appropriate and if not a safety concern. Impacts from the noise generated by prescribed fires and clearing would be reduced by limiting these activities to non-breeding seasons and using noise-reducing devices or hand-held equipment as needed.

Many wildlife species would experience short-term, minor to moderate impacts from planned wildland fire use and prescribed burns, as well as the increased use of mechanical clearing equipment as described for Alternative A. Use of mechanical equipment could result in more soil compaction and actual damage to less mobile ground-dwelling species, such as mice, snakes, and lizards. However, light-on-the-land equipment would be used in sensitive areas, and this equipment exerts a relatively small amount of pressure on the ground.

Cumulative Impacts

Cumulative impacts from Alternative B would be similar to Alternative A, but with more regionally-based reduction in fuel loading and the creation of more varied, healthy forest habitats, that exhibit a mosaic of openings and denser woodlands, resulting in long-term beneficial effects. Additional use of fuel treatments in expanded areas would add to the cumulative effects of noise and disturbance from personnel, equipment, and possibly aircraft. Impacts of actions under Alternative B, combined with impacts from other actions that could affect wildlife, would result in adverse, minor to moderate cumulative impacts to wildlife species.

Conclusion

Alternative B would result in minor to moderate adverse impacts to wildlife and wildlife habitat, with conditions improving over time, and long-term moderate beneficial impacts from the restoration of more natural conditions and the reduction of the possibility of catastrophic wildland fire. Cumulative impacts would be minor to moderate and adverse.

Because there would be no major, adverse impacts to wildlife whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant NPS planning documents, there would be no impairment of the park's wildlife.

Cultural Resources

Affected Environment

Human use of what is now Zion dates back to at least 8,000 years B.P. (before present). During the Archaic period (approximately 6000 B.C.- A.D. 500), small mobile groups hunted game and collected wild plants, seeds, and nuts across the Great Basin and western Colorado Plateau, leaving behind only a few traces in the archaeological record. By about 300 B.C. Basketmaker groups had begun to supplement wild foods in their diets by cultivating vegetables. Soon this intensified into full time agriculture typical of the Formative period (A.D. 500-1300). The Ancestral Puebloan (Virgin Anasazi) and Parowan Fremont practiced agriculture, produced ceramics, traded widely, and began to use the bow and arrow. Both groups disappeared from the archaeological record of southwestern Utah by about A.D. 1300. Extended droughts in the 11th and 12th centuries, interspersed with catastrophic flooding, may have made agriculture impossible, or it may be that these sedentary agricultural groups could not successfully compete for wild resources with the more mobile Numic language speakers (such as the Southern Paiute and Ute) who were in the region by at least A.D. 1100. Numic speaking groups, the sole occupants of the Zion landscape between A.D. 1300 and the late 1700s, depended on a wide range of seasonally gathered wild plants and animals.

Euro-Americans first made contact with Southern Paiute bands in the area in the late 1700s, as early explorers, like Fathers Dominguez and Escalante in 1776, and fur trappers passed through the region while it was Mexican territory. Within a few decades, traders had established well-defined routes between Santa Fe and Los Angeles through Utah. Information about the region reached the eastern United States in the 1840s encouraging pioneers, including members of the Church of Jesus Christ of Latter Day Saints (Mormons), to settle Utah Territory. In 1847, Brigham Young led Mormon pioneers to Utah Territory, and within a decade many pioneers had settled in and near the park. Mormon settlement in southern Utah began in the 1850s, with small communities in Zion Canyon by the early 1860s. Settlers diverted river water through extensive irrigation ditches to crops in the floodplains and attempted dry land farming on the plateaus. Settlers grazed cattle, horses, sheep, and goats both in the lowlands and on the

plateaus. In the late 1800s and early 1900s timber stands were heavily logged. Stumps, sawmill remnants, skid roads, and the remnants of a cable works used to lower cut lumber from the plateau to the canyon bottom are the hallmarks of this past land use.

In the early 20th century southern Utah, Zion Canyon in particular, was recognized as a potential destination for tourism, resulting in a Presidential Executive Order in 1909 creating Mukuntuweap National Monument (later to become Zion National Park). Historic land uses changed with the initial creation of this monument and subsequent acreage increases in the following decades.

Cultural Resource Documentation

Archaeological investigations at Zion began with excavations conducted by Ben Wetherill in 1933 and 1934. Additional investigations were sporadic in the following four decades and included a few surveys, site recordings, and excavations. Most important during this period is the data synthesis and reporting of Wetherill's excavations (Schroeder 1955). The University of Utah also conducted excavation of three sites in the Lamb's Knoll area (Aikens 1965). Most archaeological work in the last 30 years has been conducted in response to planned prescribed fire treatments, proposed ground disturbing projects, and boundary changes. From about the mid-1980s, archaeological investigations began to change to reflect more of a resource management perspective. While most projects consisted of small clearance surveys, a larger inventory was completed in Zion Canyon, Parunuweap Canyon, and in Kolob Canyons (Conner and Vetter 1986). Continuing development and management activities have required more intensive inventories and resource conservation oriented projects. Subsequent projects have focused on additional inventory and site identification, condition assessment, monitoring, stabilization, and ultimately, preservation of cultural resources.

Archaeologists have conducted cultural resource inventory of approximately 13 percent of the park and documented 433 archaeological sites, including both prehistoric and historic resources. Many of these sites are artifact scatters, containing prehistoric flaked stone tools and ceramics or historic period tin cans and bottles. Other site types include caves and rock shelters with cultural deposits, rock art sites, historic sawmills, Civilian Conservation Corps (CCC) erosion control features, historic roads and trails, and early 20th century oil wells. These sites reflect a continuum of human use of Zion's biological and geologic resources to satisfy basic needs for food, shelter, and raw materials.

Thirty-six Ancestral Puebloan sites, dating from approximately A.D. 500-1150, are preserved in the Parunuweap Canyon Archaeological District, which is listed on the National Register of Historic Places (NRHP). A number of these sites contain architectural features, such as pithouses, storage cists, and roomblocks. Parunuweap Canyon is unique because the prehistoric landscape has not been significantly altered and the sites retain a high degree of integrity. Data recovered from some of the sites during Wetherill's archaeological excavations in the 1930s helped to define the Virgin Branch Anasazi as a distinctive cultural entity.

In the early 1990s a special inventory focused on recording historic period resources. The Historic Base Map project began with the documentation of historic features along the Zion-Mt. Carmel Highway and the Zion Canyon Scenic Drive. Later inventory was also completed in Parunuweap and Shunes Canyons. Both inventories documented 265 historic features.

In addition to these archaeological sites and historic period features identified through inventory, cultural resources also include historic structures documented on the NPS' List of Classified Structures (LCS) and listed on the NRHP, cultural landscapes (potential), and ethnographic resources.

Cultural Resource Categories

For this planning effort cultural resources have been grouped into five site or cultural resource categories. While these categories grossly simplify the variability, integrity, and scientific significance of these cultural resources, they remain basic and meaningful interpretive units for which appropriate treatment objectives, conservation, and protection measures may be addressed. Each category is discussed below.

Open Sites. This category includes both historic and prehistoric resources. These sites generally consist of surface artifacts, such as ceramics, flaked and ground stone, tin cans, glass or miscellaneous historic debris. Some features may be present, such as upright slabs indicating the presence of subsurface fire hearths, storage cysts, or other features. This category represents most sites within the park. Open sites are found throughout the park in all vegetation zones.

Rock Art/Alcove Sites/Rock Shelters. Rock art is often closely associated with alcoves and rock shelters, and includes images pecked, painted or incised onto rock surfaces. Most of these sites are prehistoric in antiquity, but several include historic inscriptions. Many of the rock shelter sites consist of associated artifact scatters and/or features and may not include rock art.

Structural Sites. This category includes both historic and prehistoric resources that are constructed works architecturally designed or engineered for human activity. Historic resources in this category include buildings (habitation and non-habitation structures), roads, trails, bridges, irrigation ditches, wood telephone poles and fences, rock fence lines, water/soil erosion control features, and more. Most (but not all) of these resources occur in Zion Canyon or other park developed areas. Historic structures are presented in more detail below. Prehistoric resources include standing walls of habitation and non-habitation structures, granaries, or other storage features. The majority of these sites occur in Parunuweap Canyon.

Cultural Landscapes. This category refers to a geographic area that has been manipulated by humans, usually associated with a significant historic event, activity, or person. Examples are historic sawmill sites, historic districts, and farmsteads. Currently no cultural landscapes have been documented in the park. However, several areas offer the potential to be considered cultural landscapes, and will therefore be treated as deemed appropriate. These areas include all or portions of the main canyon, such as the Zion Lodge and associated landscape, or the entire main canyon along the Floor of the Valley Road, as well as historic sawmill sites (Stave Spring, Sawmill Spring, Lemon Spring, Pine Valley).

Within Zion Canyon, a cultural landscape inventory is scheduled for completion in FY 04. This inventory will evaluate the potential for a cultural landscape, including significant features such as the Floor of the Valley Road, Zion-Mt. Carmel Highway, Oak Creek Residential Area Historic District, Pine Creek Residential Area Historic District, and the Birch Creek/Zion Lodge Historic District. All of these properties are currently listed in the NRHP.

Ethnographic Resources. These resources have importance to American Indians and descendants of early pioneers and may include archaeological sites, geographic areas, or natural resources such as springs/seeps, vegetation, wildlife, or mineral deposits.

Based on oral traditions passed down through the generations, natural resources found in the Virgin River watershed (which includes Zion) are important to the Southern Paiute today for traditional, religious, and/or ceremonial purposes. Tribes are often reticent to reveal information about the type or location of traditional properties. Accordingly, no specific sites or locations have been listed in this document. Southern Paiute tribes, including the Kaibab Band of Paiute Indians, Paiute Indian Tribe of Utah, Moapa

Paiute Tribe, Las Vegas Paiute Tribe, and the San Juan Paiute Tribe have demonstrated interests in the areas of Zion that are covered by this environmental assessment (Stoffle et al. 1995).

Historic Structures

Structures are constructed works that are architecturally designed or engineered to serve a human activity. These may include buildings, roads, trails, bridges, irrigation ditches, or earthen berms, to name a few. While the majority of the park's historic resources are related to early park development, a few remnants of Mormon pioneer settlement remain as well. Currently, there are 91 historic structures listed on the LCS. Eighty-five of those structures are listed on the NRHP, either as individual properties or as a contributing feature within a historic district. National Register significance affords certain cultural resources a heightened awareness of importance and protection. Most of the park's structures are located in Zion Canyon. Most buildings have wood roof coverings, and are exposed to lofted firebrands from nearby fires. There is little risk of a direct flame impingement, since most are constructed of stone and recent fuel reduction activities have cleared flammable vegetation from around the structures. On-going maintenance and fuels operations maintain defensible space to a standard of 30 to 50 feet. Most are used for employee housing or support facilities. The following list includes all properties and districts listed in the National Register.

Districts:
- Zion Lodge/Birch Creek Historic District – includes all the historic cabins but not the lodge itself, which was rebuilt in 1968 after it was completely destroyed by structural, not wildland, fire. This district also includes four buildings at the Birch Creek, for a total of 22 structures.
- Oak Creek Utility/Residential Historic District – includes all the maintenance buildings and the historic residences and garages in the Oak Creek housing area, for a total of 20 structures.
- Pine Creek Residential Historic District – includes three houses and two garages, for a total of five structures.
- Parunuweap Canyon Archaeological District – includes 36 prehistoric archaeological sites.

Trails:
- Angels Landing/West Rim Trail
- Canyon Overlook Trail
- East Rim Trail
- Emerald Pools Trail
- Riverside Walk
- Grotto Trail
- Hidden Canyon Trail

Irrigation Ditches:
- Crawford/Gifford Canal
- Oak Creek Canal
- Pine Creek Canal
- Flanigan Ditch

Other Buildings and Structures:
- Cable Mountain Draw Works
- East Entrance Sign
- East Entrance Checking Station
- East Entrance Ranger's Residence

- South Entrance Sign
- Museum (Grotto Residence)
- Grotto Camping Ground North Comfort Station
- Grotto Camping Ground South Comfort Station
- South Campground Comfort Station
- Temple of Sinawava Trailside Exhibit Building
- South Campground Amphitheater
- Zion Inn (Zion Nature Center)

Transportation Structures:
- Zion-Mt. Carmel Highway – includes the road from Canyon Junction to the East Entrance. The Virgin River Bridge, switchbacks, Pine Creek Bridge, and the tunnel are all contributing features.
- Floor of the Valley Road – includes the road from Canyon Junction to the Temple of Sinawava. The Cable Creek Bridge and several parking areas are contributing features.

Impact Threshold Definitions

Negligible	The impact is at the lowest levels of detection – barely perceptible and not measurable.
Minor	For archaeological resources, the impact affects an archaeological site(s) with modest data potential and no significant ties to a living community's cultural identity. The impact does not affect the character-defining features of a NRHP eligible or listed structure, district, or cultural landscape.
Moderate	For archaeological resources, the impact affects an archaeological site(s) with high data potential and no significant ties to a living community's cultural identity. For a NRHP eligible or listed structure, district, or cultural landscape, the impact changes a character-defining feature(s) of the resource but does not diminish the integrity of the resource to the extent that its NRHP eligibility is jeopardized.
Major	For archaeological resources, the impact affects an archaeological site(s) with exceptional data potential or that has significant ties to a living community's cultural identity. For a NRHP eligible or listed structure, district, or cultural landscape, the impact changes a character-defining feature(s) of the resource, diminishing the integrity of the resource to the extent that it is no longer eligible to be listed in the NRHP.
Duration	Short-term - treatment effects on the natural elements of a cultural landscape may be comparatively short-term (e.g., three to five years until new vegetation grows or historic plantings are restored, etc.). Any effect from treatments to archaeological, historic, or ethnographic resources would be considered long-term (see below).
	Long-term - because most cultural resources are non-renewable, any effects on archaeological, historic, or ethnographic resources, and on most elements of a cultural landscape, would be long-term.
Area of Analysis	Within park boundary

Effects of Alternative A – No Action Alternative

Under Alternative A, fuels reduction activities would be limited, with a resultant increase in fuel loading over time, making uncontrolled wildland fire more likely. Archaeological and historic sites and features, both buried and on the surface, may be placed at risk from unwanted wildland fires and associated suppression activities. Sites with flammable wooden elements are especially vulnerable. Heating associated with fire can cause smudging, cracking, or other damage to artifacts and ruins. Adverse impacts also may result from human activities, such as fire line and helispot construction, and fuel reduction activities. While some of the disturbances caused by suppression could be avoided by careful

planning of hand lines, the ability to consider and protect all cultural resources during a wildland fire is difficult.

Historic structures located within inholdings or adjacent to park boundaries also may be at risk from uncontrolled wildland fires. Fortunately, most of the park's archaeological and historic sites are located in areas protected from wildland fires due to natural or man-made barriers. In addition, pre-suppression and routine maintenance activities would help to maintain structural clearance from surrounding vegetation.

Actions and policies proposed in the park's 1992 Fire Management Plan also would help reduce potential impacts from wildland fire. Over time, some fuel loads would be reduced, providing minor, long-term, beneficial effects on cultural resources. However, fuel sources could increase in some other areas, resulting in long-term, minor to moderate, adverse impacts.

During suppression of wildland fires, mitigation would include some or all of the mitigation strategies described previously in Chapter 2 under *Mitigation Measures for Alternative A*. Any or all of these mitigation measures would be executed under the supervision of a qualified cultural resources specialist. However, because unidentified resources could not be protected in case of unplanned fire, and because professional expertise and many of the mitigation measures may not be available for some areas during uncontrolled wildland fire, cultural resources could suffer minor to moderate long-term adverse impacts, both direct and indirect.

There is the possibility that fire or use of equipment could expose previously unknown sites or artifacts that had been obscured by vegetation or forest litter, which could be viewed as a benefit. Post-fire cultural resource surveys would be conducted to identify and evaluate newly discovered sites and/or document damage to known sites. A plan would be developed to ensure site stabilization or information retrieval, and during rehabilitation of fire control lines, care would be taken to avoid damage to cultural resources.

Fires or damage from suppression activities could result in unacceptable changes to character-defining elements of historic districts or structures. That is, fire and suppression activities could remove important landscape elements, structures or historic sites, and unsightly burned and scorched vegetation, stumps, and unvegetated fire lines would diminish the visual integrity of the landscape.

Since the park's cultural resources are nonrenewable, most adverse effects on cultural resources would be considered direct and long-term. The intensity of impacts would depend on the intensity, duration, and location of the fire, and the mitigation efforts that could be implemented. Given the higher potential for more intense wildland fire as time goes on, Alternative A would result in minor to moderate, short- and long-term, direct and indirect adverse impacts to cultural resources.

Cumulative Impacts

Visitors, local residents, government agencies, and the general public affect fire management decisions on a regional basis. Some agencies and residents may take measures to reduce fire hazards, while in other areas fuels may continue to accumulate. Uneven fuel reduction efforts inside and outside the park boundaries could contribute to cumulative losses of cultural resources by creating fire-prone "pockets" of fuel. Uncontrolled wildland fires could move into adjacent public and private lands, damaging important cultural resources.

The lands within and surrounding Zion may also contain unknown cultural sites, and Alternative A would add to the cumulative losses of cultural resources from wildland fires over a broader area. Cultural resources are also lost through natural erosion, unauthorized collection, and damage from vegetation

growth. Smaller, planned maintenance projects for the park would not contribute substantially to cumulative impacts, since these can be planned in advance, incorporating site surveys and use of various mitigation measures.

Ethnographic use of fire to manage vegetation is well documented by archaeological investigation and cultural traditions of the Paiute people. Many plant communities found in the park are fire-adapted or fire dependent. Management and prescribed use of fire can have positive impacts on vegetation resources of ethnographic interest. Lack of fire fuels management and complete fire suppression in most areas outside the park tend to reduce vegetation diversity and the populations of ethnographic interest.

Overall, impacts of actions described under Alternative A, combined with impacts from other actions that could affect cultural resources, would result in minor to moderate, adverse cumulative impacts to cultural resources, due to the risk of uncontrolled wildland fire, collecting, erosion, and soil or ground disturbance.

Conclusion

Alternative A would result in minor to moderate, adverse impacts on cultural resources in the park. Short-term impacts may occur, but most impacts would be considered long-term due to the non-renewable nature of these resources. Cumulative impacts would be minor to moderate, long-term and adverse from fire, collecting, erosion, and soil/ground disturbance.

Because there would be no major, adverse impacts to cultural resources or values whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's cultural resources or values.

Effects of Alternative B – Proposed Action/Preferred Alternative

Under Alternative B, the selective use of wildland fire and prescribed fire, plus the proposed fuels reduction activities, would help prevent extreme wildland fires in the future. Prescribed fire would be conducted in less sensitive areas and mostly in areas where manual thinning has already reduced the density of fuel so that burns could be controlled and kept at low intensity. Also, all prescribed burn plans would adhere to requirements of NHPA, and pre-burn surveys and the implementation of cultural resource protection measures (such as fire shelters) would keep impacts to minor levels.

During thinning, some unknown sites could be damaged by vehicular traffic and work crews trampling sites and dragging slash over the ground surface. Damage would be managed by cutting limbs and brush into sizes that can be transported without dragging or heavy vehicular use. All slash burning areas would be located away from known resources, or located in previously disturbed areas that have been surveyed. Direct adverse impacts from thinning would be minor. Use of light-on-the-land equipment would be specified to reduce impacts to soils and sites from vehicular traffic.

Prescribed burns can result in exposure of surface soils and previously unknown sites, with possible subsequent erosion and loss of site integrity. These impacts would be reduced by careful pre-planning and archaeological monitoring of all burns. If unanticipated sites were discovered, the archaeologist would halt work and protect the area until further investigations could be completed in consultation with the Utah SHPO. Ethnographic resources would be protected through the careful planning of fires and fuel reduction, and by working with tribes and SHPO to identify such resources.

Implementation of the new Fire Management Plan would result in benefits such as increased defensible boundaries, lower fire intensities, and lower heating residence times over the long-term. Overall, Alternative B would have long-term, minor, adverse impacts to cultural resources, with long-term, moderate beneficial effects.

Cumulative Effects

Visitor use, local residents, and the general public may add cumulatively to fire management activities, including firefighter presence around these values as prescribed fire operations increase. With the increased interagency coordination and provision for fuel reduction and wildland fire use across the park boundary, long-term cumulative adverse impacts to cultural resources would be reduced. Overall, impacts of actions described under Alternative B, combined with impacts of other actions that could affect cultural resources, would result in minor, adverse, cumulative impacts to cultural resources, with long-term moderate beneficial impacts due to the decreased potential for more intense and widespread wildland fires.

Conclusion

Alternative B would result in long-term, minor, adverse impacts to cultural resources, with some moderate, long-term beneficial impacts from eliminating the threat of extensive, high-intensity fires and reducing damaging fuels. Cumulative impacts would be short-term, minor, and adverse, with long-term, moderate beneficial effects.

Because there would be no major, adverse impacts to cultural resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Zion National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's General Management Plan or other relevant National Park Service planning documents, there would be no impairment of the park's cultural resources or values.

Section 106 Summary: After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementation of the preferred alternative would have *no adverse effect* on cultural resources of Zion National Park.

Economic Considerations

Affected Environment

Zion National Park is located in the State of Utah in portions of eastern Washington County, western Kane County, and eastern Iron County. Washington and Kane Counties are most closely linked economically (via tourism) to Zion because the eastern and southern access points to the main visitor use areas of the park (Zion Canyon and the Zion-Mt. Carmel Highway) are located in these counties.

Population

Between 1980 and 1990 the United States' population grew by approximately 9.8 percent and from 1990 through 1995 by more than 5.4 percent. During the same time, the population of Utah grew at nearly double the national rates. Since 1980 the three counties in which Zion lies have experienced even higher population growth rates than either the state or national averages.

Specifically, Washington County, with an estimated population of 100,000 (U.S. Census Bureau, 2001) and containing the city of St. George and most of Zion, has experienced tremendous growth, expanding

by more than 42,000 people (nearly 86 percent) between 1990 and 2000 (U.S. Census Bureau, 2003). Most of this growth has centered on the St. George area. The city of St. George experienced a 74 percent increase in population, totaling 21,161 people between 1990 and 2000 (St. George Area Chamber of Commerce, 2003) and accounting for half of the total growth for Washington County. Population growth is expected to continue in Washington County through the life of this plan.

Gateway communities of Springdale (population 457) and Rockville (population 247) are located west of the park's south entrance. The town of Virgin (population 394) is located 13 miles to the west of the park along State Route 9 and at the junction to the Kolob Terrace Road (U.S. Census Bureau, 2000).

Kane County has an estimated population of 6,058 (U.S. Census Bureau, 2001) and has experienced a 17 percent increase in population from 1990 to 2000. The city of Kanab, with a population of 3,289 (Utah Travel Center, 2003), is home to approximately half of the county residents. Kanab is located 45 miles southeast of the park.

Iron County has a population estimate of 34,400 (U.S. Census Bureau, 2001) and experienced a population growth of 62 percent between 1990 and 2000 (U.S. Census Bureau, 2003). Cedar City is the most populated city within the county at 21,500 residents (Cedar City Area Chamber of Commerce, 2003), constituting an estimated 63 percent of the county's total population. Cedar City is located 18 miles north of the Kolob Canyons section of the park and 56 miles northwest of park headquarters.

The mild climate, community facilities and services, and proximity to several national parks and other public lands that offer a wide variety of outdoor recreational opportunities, have all contributed to the area's growth.

Economy

The primary economic sectors in terms of earnings are identified in Table 14. Tourism is included in service (such as lodging and restaurants) and retail trade (e.g. souvenir stores, recreation equipment). The jobs provided by the service sector, especially tourism, typically are not high paying. Tourism also tends to be seasonal in nature.

Total industry earnings ($30,207,707) for persons employed in Utah increased by 8.4 percent between 1995 and 1996 (Bureau of Economic Analysis, 1998). During the same period of time, Iron County saw an increase of 8.6 percent (for a total of $276,024), Kane County, a 8.9 percent increase (for a total of $54,475). Washington County saw an increase of 9.9 percent for a total of $791,905. All income estimates are in thousands of dollars.

Table 14: Top Three Industries in Terms of Earnings in 1996

	Industry and Percent of Total Earnings	Industry and Percent of Total Earnings	Industry and Percent of Total Earnings
State of Utah	Services (27%)	State and Local Government (12%)	Durable Goods Manufacturing (11%)
Iron County	Services (23%)	Retail Trade (14%)	State and Local Government (22%)
Kane County	Services (33%)	Retail Trade (23%)	State and Local Government (19%)
Washington County	Services (28%)	Retail Trade (17%)	Construction (16%)

Source: Bureau of Economic Analysis, Regional Economic Information System, 1998 data.

Transportation /Access

Zion National Park is one of the many destination parks located in southern Utah and northern Arizona far from the primary population centers of the country. Domestic and foreign visitors are undaunted by these distances and arrive by various types of motor vehicles every year. Interstate 15, running north and south, is the primary highway connecting the southwestern corner of Utah with the rest of the nation. Via this route, Zion is 42 miles from St. George, which is connected with Salt Lake City to the north and Las Vegas, Nevada and southern California to the south. Interstate 15 also intersects Interstate 70 about 125 miles north of St. George, which in turn connects with Denver, Colorado, to the east. Access to the Kolob Canyon area of the park is directly off of Interstate 15. To get to the southern entrance of the park, visitors take Interstate 15 to State Route 9 and drive 42 miles to Springdale. To reach the eastern entrance of the park, visitor use US Route 89 and State Route 9 via Panguitch or Kanab.

Visitor Services

Communities in southwest Utah have a variety of restaurants, motels, souvenir shops, and other retail establishments offering goods and services to the traveling public. Communities that provide these services near Zion include Cedar City, Kanab, St. George, and Springdale. The abundance of lodging facilities, including campgrounds, as well as eating establishments in this area attest to the importance of tourism in the region. Automotive services, medical services, and other visitor services are available in some communities.

Rockville and Springdale serve as the southern gateway to the most heavily used areas of Zion. Springdale, with approximately 300 permanent residents, is adjacent to the park's south entrance. Fourteen motels, lodges, and inns, and eleven bed and breakfast establishments are located within Rockville and Springdale. The lodging facilities range from small bed and breakfasts with two to five units, to a lodge that offers 120 units. Nearly 500 lodging units are available to the public with new units currently under construction. In addition, there is a privately owned campground (open to the public) in Springdale. At least a dozen restaurants were open in Springdale as of 2003.

The local (Zion Canyon) economy is based on tourism, ranching, fruit production, and the arts. Springdale has a chamber of commerce (Zion Canyon Chamber of Commerce, 2003), a medical clinic (open seasonally), and a post office and town offices. In addition to lodging and food establishments, many shops and galleries offer souvenirs and a variety of local crafts and original art.

The east entrance of the park is in Kane County. Two privately owned campgrounds (open to the public), a service station, curio shop, and two food establishments are located between the park boundary and Mt. Carmel Junction. The town of Mt. Camel Junction has three motels, two campgrounds, a golf course, service station, and several restaurants that provide food and overnight accommodations for persons traveling via US Route 89 and State Route 9. While private property east of the park has seen a dramatic increase in home construction, fewer people use the east entrance as compared to the south entrance.

Southeast of the park, 17 miles from Mt. Carmel Junction, is Kanab – the largest town in Kane County. Kanab is the county seat and serves as a recreational and commercial center for Kane County and the Arizona Strip. A Bureau of Land Management visitor information center is located here, as well as a range of commercial services, including lodging, automotive services, restaurants, and several local tourist attractions featuring Old West and Hollywood movies themes. The town has about two dozen lodging establishments and over twenty restaurants.

Cedar City is located about 18 miles north of the Kolob Canyons entrance to the park. Visitor services that are available in Cedar City include 56 lodging establishments, 7 campgrounds, and close to 60 restaurants. Cedar City is home to Southern Utah University and the internationally recognized

Shakespearean Festival. Nearby access to Cedar Breaks National Monument and Brian Head ski resort provide a few of the many area recreational opportunities. The tribal office for the Paiute Indian Tribe of Utah is located here as well.

Regional Land Ownership and Use

Zion National Park is surrounded by a mix of federal, state, and privately owned lands. The Bureau of Land Management manages public lands that lie along 57 percent of the park's boundary. State of Utah school trust lands are found next to slightly less than 8 percent of Zion's border. Privately owned lands surround approximately 35 percent of the park. The lands bordering the park are used for a variety of purposes, including ranching, recreation, private residences, and commercial uses.

Table 15 and Map A display the general land ownership patterns of the three counties in which the park is located. A large area of each of these three counties is publicly owned, with the federal government managing the largest portions of each county. The BLM, USFS, NPS, and Bureau of Indian Affairs (BIA) all manage federal lands within the three-county area. The State of Utah owns and manages numerous school trust parcels throughout these counties. In addition, six state parks are located in the area. The amount of area in private ownership ranges from approximately one-third in Iron County to less than one-twentieth in Kane County.

The lands in this corner of Utah are used for a variety of purposes, including, but not limited to, agriculture (e.g., farming, ranching), mineral exploration and production (including coal, oil, and natural gas production), outdoor recreation of all types, timber production, watershed protection, wilderness, transportation (including roads, powerlines, and pipelines), wildlife and fish habitat, and urban and commercial uses. While traditional uses (such as grazing, mining, and forest products) are still important to the area's economy, other uses that are tied to the land – especially outdoor recreation and tourism – are growing in importance. The relatively mild climate and varied and abundant recreational opportunities have encouraged the development of the region for commercial, residential, tourism and vacation, and retirement purposes.

Table 15: Landownership in Southwest Utah

Land Status	Iron County		Kane County		Washington County	
	Square Miles	Percentage of Total Area	Square Miles	Percentage of Total Area	Square Miles	Percentage of Total Area
Private	1,777	36%	218	5%	412	17%
State	202	6%	437	10%	121	5%
Federal	1,922	58%	3,718	85%	1,892	78%
Total	3,901	100%	4,373	100%	2,425	100%

Source: Iron, Kane, and Washington County Governments

Impact Threshold Definitions

Negligible	No effects would occur, or the effects to socioeconomic conditions would be below or at the level of detection.
Minor	The effects to socioeconomic conditions would be detectable. Any effects would be small and, if mitigation is needed to offset potential adverse effects, would be simple and successful.
Moderate	The effects to socioeconomic conditions would be readily apparent. Any effects would result in changes to socioeconomic conditions on a local scale. If mitigation is needed to offset potential adverse effects, it could be extensive, but would likely be successful.
Major	The effects to socioeconomic conditions would be readily apparent and would cause substantial changes to socioeconomic conditions in the region. Mitigation measures to offset potential adverse effects would be extensive and their success could not be guaranteed.
Duration	Short-term - occurs only during the treatment effect/project period.
	Long-term - occurs after the treatment effect/beyond project period.
Area of Analysis	Washington, Kane, and Iron Counties

Effects of Alternative A – No Action Alternative

Under Alternative A, fuels would continue to accumulate, resulting in short-term, indirect, adverse and beneficial impacts to the local economy in the event of a wildfire. The influx of firefighters would result in the need for temporary local housing and the additional purchases of food and other supplies from local merchants — a minor beneficial impact. However, the park and surrounding areas could close or access may be very limited during these incidents, which would result in fewer tourists and recreationists visiting the local communities and purchasing food, supplies, and lodging. This loss of tourism and recreation revenue would result in a minor, indirect, short-term adverse impact on local socioeconomics. However, the chance of a more extensive wildland fire grows with each year of limited fuels management. A large wildland fire would create some short-term benefits to the local economy due to the needs of the temporary crews. However, such a fire would result in more consequential, long-term, minor to moderate adverse impacts, because visitation would decrease not just during the fire event, but after the event as well, until the park and surroundings reopened and visitors returned to the area. The length and severity of this impact would depend on the length and severity of the fire, whether or not the fire damaged some of the more widely used areas (such as in the canyon and the campgrounds), and when the fire occurred. It is more likely that an extensive wildland fire would occur during the dry summer months, when visitation would normally be highest and the impacts of the lack of income from decreased visitation would be most severe.

In addition to the impacts mentioned above, the actual cost of fighting any fire, especially extensive wildland fires, can be great and result in decreased public resources and support being available for other purposes in and around the park. This could have a minor, indirect, adverse, long-term impact to the local economy and other regional economies if projects that would have enhanced area tourism are cancelled due to lack of funds because of firefighting related expenditures.

Cumulative Effects

Cumulative impacts to the local economy include those that could result from the park's actions plus those resulting from the fire policies of the surrounding landowners, visitor use, increased recreational and private development in and near the park, and fuel reduction treatments carried out on public or private lands near the park, which can influence the spread of fire into the park. The effects from the smaller maintenance projects would be very short-term, and access would not be denied to most areas of the park. However, the firefighting activities that would be expected in the park and surrounding lands would create similar demands on the local economy for lodging, food, and support supplies as described

above, resulting in minor to moderate, short- and long-term cumulative adverse impacts to the local economy. Those who would receive revenue from the firefighter presence would experience some short-term beneficial gain. Again, the intensity of these impacts would depend on the length and severity of the fire, whether or not the fire damaged some of the more widely used areas, and when the fire occurred. It is more likely that an extensive wildland fire would occur during the dry summer months, when visitation would normally be highest and the impacts of the lack of income from decreased visitation would be most severe. Overall, impacts of actions under Alternative A, combined with impacts of other actions that could affect local socioeconomics, would result in short- to long-term, minor to moderate, adverse cumulative impacts, with short-term benefits to the local economy.

Conclusion

Alternative A would result in short- and long-term, indirect adverse impacts to local socioeconomic conditions, with some beneficial short-term impacts from the revenue generated by the presence of fire crews. Adverse impacts would include loss of revenue and the cost of suppression, as well as costs associated with fighting a possibly extreme wildland fire. These impacts would be minor to moderate, depending on the length and severity of the fire, the location of the fire, and when it occurred. Cumulative effects from Alternative A would be short- to long-term, minor to moderate, and adverse.

Effects of Alternative B – Proposed Action/Preferred Alternative

Under Alternative B, there would be less chance of extreme wildland fires over time due to the reduction of fuels in the park and wildland fire use within the park and across boundaries. This would result in a long-term, indirect, minor beneficial impact to the local economy, since the possibility of loss of revenues, especially long-term loss of revenue due to wildland fire would be substantially reduced. Avoiding wildland fire damage and the resultant costs of firefighting would also add to the beneficial impacts of this alternative, including lodging and food for the temporary work crews and supplying the fuel needed to fight the fire. The actions prescribed for use of wildland fire and prescribed fire, as well as manual fuel reduction, would involve short periods when parts of the park would be closed to visitor use. However, this would cause a minor drop in visitation during those periods, especially since the prescribed fires and fuel reduction activities could be planned for seasons of low visitor use, or would occur in a manner that would not greatly limit visitation whenever possible. Some wildland fire use or prescribed fires could last for up to 30 days, which could cause more impacts to visitors in certain areas of the park. Overall, activities planned under Alternative B would have minor to moderate, short-term, adverse impacts on the local economy, with the intensity dependant on the length of time fire use continued in the park.

Cumulative Effects

Cumulative impacts to the local economy would be similar to those described under Alternative A. The effects from the smaller maintenance projects would be very short-term, and access would not be denied to most areas of the park. However, because of the fuels reduction program and the use of wildland fire defined under this alternative, fewer extensive wildland fires would occur. Adverse impacts on the local economy from such instances would be minor and short-term, with long-term beneficial impacts to the local and regional economies as a result of the protection of local economic resources from the adverse effects and costs of wildland fire suppression. Also, fuel reduction activities would provide short-term increases in wages and work activities associated with fuel reduction projects. Overall, impacts of actions described under Alternative B, combined with impacts of other actions that could affect local socioeconomics, would result in short-term, minor, adverse cumulative impacts, with short-term benefits to the local economy.

Conclusion

Alternative B would result in short-term, minor to potentially moderate, adverse impacts to the local economy during the periods of some fuels reduction activities or wildland fire use, which would require restrictions on park use. However, long-term, beneficial impacts would result from the increased protection from costly wildland fires, including both the direct firefighting costs and the indirect costs to the local economy from the reduction in visitation and recreation revenues. Short-term, beneficial impacts would result from the increases in wages and work activities associated with fuel reduction projects or wildland fire use. Cumulative effects to the local economy would range from short-term, minor, adverse to long-term and beneficial from the reduced potential of a large-scale wildland fire.

Park Administration and Visitor Facilities

Affected Environment

Budget

Through congressional appropriation, Zion receives an annual budget in support of park operations and administration. The base operating budget in 2003 was $5,855,500, with an additional $517,300 for special park project funding. Project funding is used for a variety of projects such as new construction; cyclic building maintenance; resource restoration, treatments, or research; and interpretation. Funding from the Recreational Fee Demonstration Program has been utilized since 1997 to complete park-wide backlog projects that are non-recurring. The National Park Pass Program is currently being used to supplement contract obligations for operation of the transportation system (USDI, NPS, 2002c).

Annual funding for the Fire Management Program is approximately $1.7 million for program operations, with an additional $300,000 for project implementation. This funding is based on historic fire occurrence and workload over a 10-year average. Funding is generated by the FIREPRO analysis through the Department of the Interior. Fire funding is divided into two main areas — fire preparedness and fuels management. Fire preparedness includes fire suppression resources, helicopter and firefighters, while fuels management includes fire monitoring studies, public information and education, and fuel reduction and project management. Fuels funding allows for additional support for archaeological, threatened and endangered plant/animal surveys to meet federal and state environmental compliance requirements, and GIS/Global Positioning System data gathering and processing and cartographic map products.

Staffing

Generally, employment at Zion increases in late March/early April. By mid-July the park is in peak season, and by mid-August the seasonal staff begins to decline as visitation recedes. By mid-to-late October, the majority of the seasonal staff is gone. In 2003, Zion had 106 permanent employees and 56 less than full time employees (e.g., temporary, term, or seasonal appointments).

Infrastructure by Geographic Area

The majority of the park "built" environment (e.g., visitor and park use facilities, roads, trails) as described in the GMP is in the administrative, frontcountry high development, frontcountry low development, and transition zones. There is limited development, mainly roads and some trails, in the primitive, pristine, and research natural area zones. Un-maintained routes (hiking and technical climbing) are found in all GMP zones, with the exception of the administrative zone.

Zion Canyon: Seven shuttle bus stops (Canyon Junction, Court of the Patriarchs, Zion Lodge, Grotto Picnic Area, Weeping Rock, Big Bend, and the Temple of Sinawava) and associated shade shelters are situated along the six-mile section of the Zion Canyon Scenic Drive. The road and associated pullouts,

culverts, and stone masonry retaining walls are listed on the National Register of Historic Places (McKoy and Sontag, 1995).

The Zion Lodge Historic District has the highest concentration of buildings in Zion Canyon, including the lodge, 2 motel buildings with 84 units, 15 Western Deluxe Cabins with 40 units, a recreation hall, 4 employee housing units, and a 10-space employee trailer park. The historic Western Deluxe Cabins, 2 employee dormitories, and 2 outbuildings are listed on the National Register (Jurale and Witherall, 1984).

One mile south of Zion Lodge is the Birch Creek Historic District. Three of the four buildings are leased by the Canyon Trail Rides horse concession. The fourth building is leased by the lodge concession (Xanterra) and used for storage. Three mobile homes (owned by the horse concession and used for wrangler housing), a culinary water chlorination building, and water storage tank are also located at Birch Creek. There are two developed springs within the Birch Creek drainage. One restroom facility is located on the Sand Bench trail.

To the north of the lodge complex is the Grotto Picnic area. Three historic structures, listed on the National Register, are located here — two restrooms and one park administrative structure. The popular West Rim trailhead is accessed via a bridge crossing the river to the west of the picnic area.

Two miles north of the Lodge is a trailhead access for Weeping Rock, Hidden Canyon, East Rim, and Observation Point hiking trails. One restroom facility is located in the Weeping Rock parking area.

The Temple of Sinawava is the terminus of the Zion Canyon Scenic Drive and is a popular area for access to the Riverside Walk. Water supplied to a restroom and drinking fountain is conveyed via an underground waterline from a developed natural spring on the west side of the river.

Park Administrative/Visitor Service Facilities: The park headquarters building provides administrative office space for NPS and Zion Natural History Association (ZNHA) employees. The Human History Museum, located within the park headquarters buildings, includes a museum exhibit area, auditorium, and small retail sales outlet for ZNHA. The headquarters building was constructed in 1959, during what is known by the NPS as the "Mission 66" period. To the west of park headquarters is a new emergency operations building, which provides office and garage space for park fire trucks and emergency vehicles. A modular unit that houses the Resource Management staff is also located to the west of the headquarters building.

Three housing areas, Pine Creek (3 houses and 2 garages), Watchman (14 houses with attached garage), and Oak Creek (10 houses, 3 garages, and 1 employee dormitory) are within the developed area. Buildings in Pine Creek and Oak Creek are either listed or eligible for listing on the National Register. An automated weather station is located north of the Watchman housing area.

There are two kiosk entrance stations, two park housing units, and a chlorination building at the East Entrance to the park. One of the kiosk stations and one housing unit is listed on the National Register of Historic Places. One small area provides visitor parking for the East Rim Trail.

The Oak Creek Historic District maintenance area, listed on the National Register, includes several buildings that were built by the Civilian Conservation Corps. Included within the district are a warehouse, offices, mechanics shop, carpenter shop, storage, and fire station.

Watchman and South Campgrounds are located near the South Entrance of the park. Watchman has 186 campsites, with 6 group sites, 6 restrooms, and an outdoor amphitheater. The Zion Canyon Visitor Center, constructed in 2002 with associated restrooms and river entrance kiosk, is located within close

proximity to Watchman Campground. To the northeast of Watchman Campground are the administrative offices, storage, and garage building for the park transportation shuttle service. Thirty propane powered buses and 21 trailers are maintained at this facility, providing shuttle service through the town of Springdale and to the Temple of Sinawava in Zion Canyon.

South Campground has 128 campsites and 4 restrooms, one of which is on the National Register. A small picnic area and outdoor amphitheater is located on the north end of South Campground. The historic Zion Nature Center is located to the north of South Campground and is used for the Junior Ranger program and park functions. Two entrance station kiosks are located at the South Entrance to the park.

In the frontcountry high development, administrative, and frontcountry low development zones, underground utilities (e.g., water, sewer, gas, and electric) run adjacent to road shoulders or are located in previously disturbed areas. There are six large above ground propane storage tanks in the park. One is in the Oak Creek housing area (18,000 gallons), one at the transportation bus maintenance facility (30,000 gallons), and four (1,000 gallons each) at the Zion Lodge. These tanks provide fuel for the park and concession utility, as well as transportation shuttle operations. Smaller propane tanks are associated with employees' houses.

Roads/Trails/Powerlines/Radio Repeaters: There are 12 roads (paved and unpaved) totaling 60 miles and 37 hiking trails (hardened/non-hardened) totaling 88 miles within the park. Thirty un-maintained hiking routes total approximately 60 miles (USDI, NPS, 2003c).

The park boundary has a total of 45 miles (USDI, NPS, 2003c) of 5-strand barbed wire fence. An overhead 6-mile long powerline, providing the main source of electricity to the park and area communities, runs through the southern edge of the park from east of Coalpits Wash to the town of Springdale. This powerline is owned and maintained, under a NPS right-of-way, by PacifiCorp, Incorporated.

Three VHF radio repeater sites (Lava Point, Timber Top, and West Temple) are located within the park. These allow for hand held and vehicle radio communications throughout the park by relaying radio signals. Helicopters are needed periodically to transport personnel for routine maintenance and equipment upgrades to repeaters on Timber Top and West Temple because of the steep, rugged, and isolated locations.

Kolob Terrace/Lava Point/Kolob Canyons: The Kolob Terrace Road provides access to several trailheads (Hop Valley, Connector, North Gate Peaks, and Wildcat Canyon) and routes (Grapevine Spring, Right Fork of North Creek, Left Fork of North Creek). NPS backcountry ranger housing is situated at Firepit Knoll and Lava Point. There is a small (six site) primitive campground at Lava Point, along with a storage building near the ranger housing unit, as well as an automated weather station.

A visitor center (with associated ZNHA retail sales area, maintenance facility, and a residential housing unit) is located in the Kolob Canyons section of the park. The 6-mile scenic drive provides visitor access from Interstate 15 to a picnic area and the Timber Creek, Taylor Creek and LaVerkin Creek Trailheads.

Impact Threshold Definitions

Negligible	Park operations would not be affected or the effect would be at or below the lower levels of detection, and would not have an appreciable effect on park operations.
Minor	The effect would be detectable, but would be of a magnitude that would not have an appreciable effect on park operations. If mitigation was needed to offset adverse effects, it would be relatively simple and likely successful.
Moderate	The effects would be readily apparent and would result in a substantial change in park operations in a manner noticeable to staff and the public. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.
Major	The effects would be readily apparent, and would result in a substantial change in park operations in a manner noticeable to staff and the public and would be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, would be extensive, and their success could not be guaranteed.
Duration	Short-term - effects lasting for the duration of the treatment action
	Long-term - effects lasting longer than the duration of the treatment action
Area of Analysis	Within park boundary

Effects of Alternative A – No Action Alternative

Impacts on park operations would likely occur in the area of staff demand resulting from large wildland fire incidents. In the event of such a fire, park operations in other divisions would likely be disrupted by demands relating to traffic control and law enforcement, possible emergency medical services, fire information services, transporting supplies and personnel, and follow-up maintenance work. Damage from high-severity wildland fires in or near developed areas may require repairs, such as landscaping, repair of smoke damage to buildings, roads and trails repair, and sign replacement. During fuels management activities, impacts to staff would include increased public outreach and augmenting staff levels to manage the activity. This would redirect staff from other duties, but would result in minor, short-term, adverse impacts. Overall, Alternative A would have short-term, minor to moderate, adverse impacts to park operations because of the increased probability of more frequent wildland fires in and around park facilities.

Cumulative Effects

With the number of existing residential and commercial developments on the park's periphery, there is an increased potential for wildland fires to cross the park boundary. Existing high fuel levels within the park would magnify the impact of fire coming into the park from outside, or potentially provide sufficient fuels so that a fire would become uncontrolled and cross from the park onto adjacent lands. In such an event, firefighting would be more difficult and potentially more dangerous to park staff. Park staff that would have to dedicate their time to firefighting or related tasks would not be able to perform their regular duties, representing a minor to moderate adverse, indirect cumulative impact. Increased visitor use over time and regular maintenance work would also result in increased demands on staff time and would add to the cumulative, adverse impacts on operations staff. Overall, impacts of actions under Alternative A, combined with impacts of other actions that could affect park operations and services, would result in short-term, minor to moderate, adverse cumulative impacts to park operations.

Conclusion

Alternative A would result in short-term, minor to moderate, adverse impacts to park operations. Cumulative effects would also be short-term, minor to moderate, and adverse.

Effects of Alternative B – Proposed Action/Preferred Alternative

Under Alternative B, park staff would be required to carry our implementation of the proposed action, including wildland fire use, prescribed fire, and mechanical and herbicide treatments, with assistance from a supplemental workforce that would be brought in to help implement the proposed action. Park staff duties would include, but would not be limited to, monitoring weather conditions, hand clearing trees and brush, and notifying park neighbors of when and where treatment activities and burning would take place. As with Alternative A, park operations would likely be disrupted due to demands relating to traffic control and law enforcement, possible emergency medical services, fire information services, transporting supplies and personnel, and follow up maintenance work. Short-term impacts to park operations would be minor to moderate and adverse.

Long-term adverse effects on park operations would be negligible to minor in intensity, resulting from implementation of more frequent prescribed fires, wildland fire use, and additional manual fuels reduction and herbicide use. These activities would lower the potential for destructive wildland fires in and around park facilities. Therefore, park area closures would be less in number and length of time, benefiting businesses, visitors, residents and employees.

Cumulative Effects

The treatments planned within the park's boundaries, fire management projects in the surrounding area, and cooperative fire planning efforts would reduce the likelihood of a wildland fire, which would in turn reduce the potential for the disruption of park operations that would accompany wildland fire. Increased visitor use and regular maintenance work would also result in increased demands on staff time and would add to the cumulative impacts to park operations staff. Overall, impacts of actions under Alternative B, in combination with impacts of other actions that could affect park services and operations, would result in negligible, short- and long-term, adverse, cumulative impacts to park operations.

Conclusion

Alternative B would result in short-term, minor to moderate, adverse impacts to park operations. There would be long-term, negligible to minor, adverse impacts to park operations because of more frequent fuel reduction activities. Cumulative effects would be short- to long-term, minor to moderate, and adverse.

Public Health and Safety

Affected Environment

The health and safety of visitors, fire personnel, park staff, and adjacent landowners are of the utmost importance to Zion and the NPS. Wildland fires, wildland fire use, and other fire management activities can present risks to the public, firefighters, and park staff.

The park has identified two primary concerns related to health and safety from planned fire management activities and un-planned fires. The first concerns hazards directly related to fire that could affect both the public and firefighters including, being burned, trapped by the fire, or inhaling smoke. The second concerns hazards from working in a firefighting/fuels reduction environment, which mainly affects firefighters, but could also affect visitors, such as being hit by falling rocks or trees, suffering accidents with firefighting tools or equipment, tripping or falling, or suffering vehicular accidents. No deaths or serious injuries to visitors, adjacent property owners, park staff, or firefighters from wildland fire or fire management activities have occurred in Zion.

The main area of concern in the park is Zion Canyon, which is where the majority of visitors congregate (including Zion Lodge, shuttle system stops, parking areas, campgrounds, picnic areas, visitor center, roads, and trails). Other areas of concern include adjacent private lands (and around private inholdings) that border approximately 35 percent of the park. These lands are used for a variety of purposes, including ranching, recreation, private residences, and commercial uses. Backcountry areas are also of concern, since it is more difficult to inform backcountry visitors of impending danger.

The current fire management program in Zion works to mitigate long-term threats to public safety by reducing hazardous fuels with the use of prescribed fire and mechanical fuel reduction treatments adjacent to developed areas and along roadways. Wildland fires and canyon winds can cause smoke to accumulate in Zion Canyon and adjacent communities. Because of this, prescribed fires are currently conducted when winds are unlikely to blow smoke into heavily used visitor areas. Hiking trails or roads are closed when fire poses a threat to visitors.

Impact Threshold Definitions

Negligible	Public health and safety would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on the public health or safety.
Minor	The effect would be detectable, but would not have an appreciable effect on public health and safety. If mitigation was needed, it would be relatively simple and likely successful.
Moderate	The effects would be readily apparent and would result in substantial, noticeable effects to public health and safety on a local scale. Mitigation measures would probably be necessary and would likely be successful.
Major	The effects would be readily apparent and would result in substantial, noticeable effects to public health and safety on a regional scale. Extensive mitigation measures would be needed, and their success would not be guaranteed.
Duration	Short-term - effects lasting for the duration of the treatment action
	Long-term - effects lasting longer than the duration of the treatment action
Area of Analysis	Park and surrounding communities

Effects of Alternative A – No Action Alternative

Under Alternative A, fuel loads would continue to accumulate and the risk of exposure to wildland fire would increase. The potential risks to public health and safety from wildland fire would include loss of life and property, injury, and health effects caused by exposure to smoke emissions, resulting in moderate, short- and long-term adverse effects depending on the severity of the fire, its location, and weather/wind conditions at the time of the fire. During fire suppression, firefighters would be engaged in such activities as evacuations, fire line construction, and aerial fire suppression. These activities inherently involve some risk to public health and safety, but if fire suppression activities commenced rapidly and the fire was not widespread or intense, impacts to health and safety would be minor and short-term. However, with the buildup of fuel that would occur over time under Alternative A, more potential for severe fire behavior would exist, as well as more adverse impacts on the health and safety of the firefighters, park personnel, and visitors. Health of nearby residents would also be of greater concern due to indirect impact of exposure to smoke. Direct impacts, including injuries and possible loss of life and property, could also occur. However, current management practices would generally result in minor to moderate, short- and long-term adverse impacts to public health and safety, although the possibility of extreme wildland fire could cause the chances of moderate short-term impacts to increase.

Cumulative Effects

Cumulative impacts to public health and safety under Alternative A include those that could result from the park's actions, plus those resulting from the continued fire policies within the surrounding area and other activities within the park that involve health and safety issues; such activities include increased visitor use and exposure of these visitors to hazards within the park, and increased traffic and maintenance operations around the park. Adverse health and safety impacts from smaller maintenance projects or visitor use of the park would be very short-term and negligible to minor, based on the types of projects normally undertaken, the health and safety planning that would precede park projects, and prior good safety records. Overall, impacts of actions described under Alternative A, combined with impacts of other actions that could affect health and safety, would result in minor to moderate, short-term and long-term, adverse cumulative impacts to public health and safety.

Conclusion

Alternative A would result in short- to long-term, minor to moderate, adverse impacts that have more potential to increase if fuels buildup reaches levels that could support an extreme wildland fire. Cumulative effects of this alternative would be short-term, minor to moderate, and adverse primarily because of the risk of a large wildland fire.

Effects of Alternative B – Proposed Action/Preferred Alternative

Under Alternative B, there would be less chance of extreme or widespread wildland fires in the area due to the reduction of fuels in the park and wildland fire use within and across park boundaries. This would result in a long-term, indirect, beneficial impact to local and regional health and safety, since the possibility of more severe health and safety impacts due to unplanned fire and associated firefighting activities would be substantially reduced. The actions required to implement wildland fire and prescribed fire, as well as manual fuel reduction, would involve more controlled conditions and pre-planning for the protection of health and safety, as well as appropriate notification and permitting prior to taking action. Also, prescribed fires and fuel reduction activities would be planned during seasons of low visitor use whenever possible. Any herbicide used for vegetation control would be EPA approved and applied by certified applicators in accordance with label directions, and visitors would not be permitted in areas to be treated. Therefore, the potential for severe adverse impacts from fuel treatment or reduction activities would be minimal, resulting in negligible or minor, adverse, short-term impacts that are usually very localized, with few off-site adverse health and safety concerns to nearby residents.

Cumulative Effects

Cumulative impacts to public health and safety under Alternative B would be less than under Alternative A, since the additional fuels reduction over time, wildland fire use, and coordination with surrounding landowners would reduce the potential for widespread or extreme wildland fires, resulting in a cumulative beneficial impact. Overall, impacts of actions under Alternative B, combined with impacts of other actions that could affect health and safety, would result in minor, short-term, adverse cumulative effects on public health and safety.

Conclusion

Alternative B would result in more localized, short-term, negligible to minor, adverse impacts from fire and fuels reduction activities, but would also provide long-term beneficial impacts resulting from the increased protection from extreme wildland fires, which can create situations with higher health and safety risks. Cumulative effects of this alternative would be short-term, minor, and adverse.

Visitor Use and Experience

Affected Environment

In 2002, approximately 2.6 million people visited Zion. Visitors participate in a wide range of activities, including lodging and camping (both within the park and in the gateway towns), hiking, canyoneering, rock climbing, attending ranger guided programs, and nature observation (Refer to Table 16). Zion Canyon attracts the majority of visitors; most walk on at least one trail during their visit. Trails range from short, easy walks from points along the Zion Canyon Scenic Drive to long, strenuous hikes such as the East and West Rim Trails. An increasing number of visitors are using Zion's backcountry — in 2002, 7,801 backcountry permits were issued, a 97 percent increase from 1998. Overall, backcountry visitors seek varying degrees of solitude and visitors enjoy natural sounds during most of their experiences. The park's shuttle buses, which operate on the Zion Canyon Scenic Drive from April through October, are propane powered and produce a minimum of unnatural sound. Once a visitor ventures from traveled roadways, unnatural sound diminishes markedly.

Regarding fire management, every effort is currently made to allow maximum appreciation, enjoyment, and use of Zion by park visitors. Notices about planned and current fire closures are posted at visitor facilities and trailheads. Prescribed fires are planned for days when winds are unlikely to blow smoke into high visitor use areas. Fire is used to maintain a healthy, natural, diverse ecosystem for visitors to appreciate and enjoy. Whenever possible, park publications and park staff inform visitors of fire's ecological and aesthetic values to Zion. Unnatural noise is curtailed whenever possible by using non-motorized tools and equipment, and by minimizing the use of aircraft or by routing aircraft around high-use or noise-sensitive areas.

Table 16: Visitor Use

Month	Number of Park Visitors[1]	Permitted Backcountry Visitors[2]
January	70,000	129
February	67,000	105
March	125,000	928
April	227,000	1,260
May	240,000	2,387
June	325,000	3,843
July	335,000	3,654
August	348,000	3,478
September	294,000	2,690
October	223,000	2,045
November	114,000	568
December	64,000	107
Total	2,436,000	21,194

[1] Based on 5 year average (1998-2002)
[2] Permits are required for all overnight backcountry stays in Zion and for all technical slot canyons. Based on 5 year average (1998-2002)

Impact Threshold Definitions

Negligible	Visitors would not be affected, or changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the effects associated with the alternative.
Minor	Changes in visitor use and/or experience would be detectable, although the changes would be slight. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.
Moderate	Changes in visitor use and/or experience would be readily apparent. The visitor would be aware of the effects associated with the alternative and would likely be able to express an opinion about the changes.
Major	Changes in visitor use and/or experience would be readily apparent and would have important consequences. The visitor would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes.
Duration	Short-term - occurs only during the treatment effect
	Long-term - occurs after the treatment effect
Area of Analysis	Within park boundary

Effects of Alternative A – No Action Alternative

Under Alternative A, fuel loads would continue to accumulate and the risk of exposure to wildland fire would increase over time. If a wildland fire started due to the increased fuel loads, suppression activities and the fire itself would disrupt public enjoyment and use of the park for the duration of the fire, and possibly for some time after widespread or extreme wildland fires. These impacts would result from reduced access, smoke, odors, noise, and changes in natural settings and visibility.

Visual impacts would be short-term, minor to moderate in intensity, and adverse. Visual values could be affected by recent wildland fires, limited prescribed fires, and/or manual fuel reduction operations near any recreational site or developed area, and by haze impacts over larger areas. However, adverse effects from viewing a burned landscape would diminish over time, as understory vegetation recovers naturally. A wildland fire that impacts a substantial portion of the park could lead to long-term, minor to moderate, adverse impacts to the visual character of the park and therefore the public's perception of the park.

Impacts to recreational use would be short-term, minor to moderate in intensity, and adverse where closures or entry restrictions would apply. Fire activity may result in temporary closure of roads, trails, and campgrounds. Smoke may also temporarily adversely affect the recreational experience due to effects on visibility and odors, but these effects would be short-term and mitigated in part through a smoke management program. An effective public information and interpretation program would direct visitors to areas of the park not affected by smoke and help educate visitors about long-term benefits of prescribed fire and wildland fire use, also offsetting adverse impacts to visitation.

Long-term effects of current management on visitor use and experience would range from negligible and adverse to beneficial and minor to moderate in intensity where areas have been treated and recovered. However, as treated areas are limited in size under current fire management practices, there remains the potential for continued adverse short-term effects on appearance from high-severity fires where fuels have not been treated. With limited application of prescribed fire, vast areas of dense, overgrown forest areas would continue to occupy the typical scenery, broken occasionally by old burns or insect infestations. This represents a minor, adverse long-term effect on recreationist attitudes toward a system shaped by periodic, low-intensity fire, mitigated in part through a timely information and education program.

Cumulative Effects

Visitor use and experience in the park would be affected by the actions described under Alternative A, as well as by other actions inside and outside the park. The increasing number of existing residential and commercial developments on the park's periphery increases the potential for wildland fires to cross the park boundary from private property. Existing high fuel levels within the park would magnify the impact of fire coming into the park from outside, resulting in the potential closure of portions of the park to visitor use. Other maintenance and construction actions in the park, including road and facility improvements would cause short-term, adverse impacts to visitor use and experience. In addition, air tours that benefit visitors seeking that type of experience would cause adverse impacts to those seeking solitude. Overall, impacts of actions described under Alternative A, combined with impacts of other actions that could affect visitor use or experience at Zion, would result in short-term, minor to moderate, adverse, cumulative effects on visitor experience.

Conclusion

Alternative A would result in short-term, minor to moderate, adverse impacts to visitor use and experience, with long-term, minor to moderate, adverse, beneficial effects due to the reduced risk of catastrophic wildland fires. Cumulative effects on visitor use and experience would be short-term, minor to moderate, and adverse.

Effects of Alternative B – Proposed Action/Preferred Alternative

Under Alternative B, fuel reduction activities, wildland fire use, prescribed burning, mechanical thinning, or use of herbicides would cause short-term public use restrictions, resulting in minor to moderate effects on visitor use and experience in and around the affected areas. Noise associated with the use of power tools, such as chainsaws, could disrupt the visitor experience. To reduce the impact on visitor use and experience, burning activities would take place when visitor use is low and weather conditions would limit the amount of smoke and facilitate its dispersal. Smoke may also temporarily adversely affect visitors' recreational experience, but these effects would be mitigated in part from a smoke management program and an effective public information and interpretation program.

There would be short-term, minor, adverse visual impacts within the vicinity of affected areas due to the change in appearance following treatment or wildland fire use. The sight of blackened trees, slash piles, and recently thinned areas could be perceived as a visual impact on visitor experience, although many visitors would view this an as educational opportunity if provided with appropriate interpretation.

Long-term effects on visual resources would be beneficial and of minor to moderate intensity where more areas have been treated. Mixed-severity and larger scale prescribed fire treatments, combined with naturally ignited wildland fires managed for resource benefit, would result in moderately more desirable scenery in the long-term, including habitat diversity that would optimize wildlife viewing, provide enjoyment of healthy understory plant life, and present a visually desirable mosaic of age-classed overstory trees.

Cumulative Effects

Cumulative impacts under Alternative B would be similar to those expected under Alternative A, with more long-term, minor to moderate beneficial effects on visitor use and experience from reducing the risk of catastrophic wildland fire within the park. The addition of interpretive programs and exhibits would also have beneficial impacts on the visitor experience. Overall, impacts of actions described under Alternative B, combined with impacts of other actions that could affect visitor use or experience at Zion,

would result in short-term, minor, adverse, cumulative impacts to visitor experience, with beneficial impacts due to the reduced risk of catastrophic wildland fire.

Conclusion

Alternative B would result in short-term, minor to moderate, adverse to visitor use and experience, as well as moderate, beneficial impacts. Cumulative effects would include short-term, minor, and adverse impacts, as well as long-term, minor to moderate and beneficial impacts.

CONSULTATION AND COORDINATION

Public Involvement Summary

Public participation is an important component of any planning process. For the proposed Fire Management Plan and Environmental Assessment process, Zion used several strategies to involve the public. External scoping was initiated in January 2003 and continued throughout the planning process. To facilitate public scoping, the park:

- Distributed over 1,000 scoping newsletters to individuals, organizations, and government agencies. The newsletter outlined the proposal and described the process for public involvement.
- Posted the newsletter and workshop notices on the Zion Internet homepage.
- Hosted four public information workshops in surrounding communities (Springdale, UT, Feb. 4, 2003; Hurricane, UT, Feb. 10, 2003; Cedar City, UT, Feb. 11, 2003; Kanab, UT, Feb. 13, 2003); 32 interested individuals attended the workshops.
- Published notices of the planning/environmental assessment process and workshops information in local newspapers.
- Broadcast over 30 announcements for the public information workshops on four local radio stations.

The park received 43 scoping comment letters. The general concerns identified in the letters and areas where those concerns are addressed in this document are summarized below.

Addressed in the *Alternatives Considered but Dismissed from Analysis* section

- Sell trees for firewood or lumber.
- Use full suppression on all wildland fires.
- Use domestic livestock to reduce fuels.

Addressed in the *Issues Considered and Dismissed from Further Consideration* section

- An evacuation plan for areas adjacent to the Zion should be included in the plan.
- Zion has certain water rights that they must adhere to.

Addressed in the *Proposed Action/Preferred Alternative* section

- How will Zion protect private property and infrastructure adjacent to the park from fires starting in the park?
- How will fire management activities affect ecosystems and natural processes?
- How will fire management activities affect all wildlife?
- How will fire management activities affect water quantity and quality?
- How will fire management activities affect the spread of non-native invasive plant species?
- How will fire management activities affect cultural resources?
- How will fire management activities affect wilderness and wilderness values?
- How will fire management activities affect smoke dispersal and air quality?
- Zion should coordinate with adjacent land management agencies and private property owners on fire related activities.
- How will fire and fire management activities affect the aesthetic values and scenery in Zion?

National Historic Preservation Act. In accordance with the NHPA, letters requesting tribal consultation were mailed to the following tribes: Hopi Tribe, Kaibab Paiute Tribe, Moapa Band Paiute Tribe, Northern Ute Tribe, Paiute Indian Tribe of Utah, Southern Ute, Ute Mountain Ute, White Mesa Ute, Navajo Tribe, Skull Valley Goshute, Goshute Indian Tribe, Pueblo of Zuni, and San Juan Southern Paiute. One

response letter was received from the Southern Ute Indian Tribe. Their concerns centered on the park's responsibilities under the National American Grave Protection and Repatriation Act.

State Historic Preservation Office. A letter requesting scoping comments was sent to the State Historic Preservation Office in January 2003. No comments were received. A copy of this document will be sent to the SHPO for review and comment as part of the Section 106 process.

U.S. Fish and Wildlife Service. Park staff contacted the U.S. Fish and Wildlife Service by letter on March 12, 2003. A reply identifying endangered and threatened species in and around the park was received on April 28, 2003. This correspondence can be found in Appendix E. A copy of this document will be sent to the USFWS for review and comment.

List of Preparers

Name	Project Role	Title
National Park Participants		
Jock Whitworth	Review	Superintendent (Zion)
Jan Passek	Project Lead	Fire Management Officer (Zion)
Henry Bastian	Vegetation, Fire History, Fire Program, Project Assistant	Fire Ecologist (Zion)
Jeff Hickerson	Fire Program	Assistant Fire Management Officer (Zion)
Jeff Bradybaugh	Review	Chief Resource Management and Research (Zion)
Jack Burns	Economics Considerations, Park Administration and Visitor Facilities, Public Health and Safety	Assistant Chief Resource Management and Research (Zion)
David Eaker	Information/Education	Fire Information/Education Specialist (Zion)
Sarah Horton	Cultural Resources	Archaeologist (Zion)
Sharon Kim	Wildlife, TES Animals	Wildlife Biologist (Zion)
Denise Louie	Vegetation, TES Plants	Botanist (Zion)
Jim Lutterman	Maintenance Activities	HVAC Mechanic (Zion)
Ray O'Neil	Backcountry Visitor Use and Experience, Wilderness	Plateau Ranger (Zion)
Kezia Nielsen	NEPA	Environmental Protection Specialist (Zion)
Elena Robisch	Data Compilation, Maps	GIS Specialist (Zion)
David Sharrow	Water Quality, Hydrology, Soils, Air Quality	Hydrologist (Zion)
Bob Showler	Frontcountry Visitor Use and Experience	Supervisory Naturalist (Zion)
Eva Long	NEPA Review	Environmental Protection Specialist (Intermountain Regional Office)
Consultant Participants		
Nancy VanDyke	Author – Chapter 4 Wildlife, TES Animals, TES Plants, Vegetation, technical review	Consultant Project Manager
Lisa Pine	Author – Chapter 4 – Air Quality, Soils, Water Quality and Hydrology, Wetlands, Natural Soundscapes, Wilderness, Economic Considerations, Park Administration & Visitor Facilities, Public Health and Safety, Visitor Use and Experience	Environmental Planner
Bob Mutaw	Cultural Resources	Cultural Resources Manager
Andy Richardson	Document Editing	Editor

List of Environmental Assessment Recipients

Federal Agencies

Advisory Council on Historic Preservation
Bureau of Land Management
- Arizona Strip Field Office
- Cedar City Field Office
- Grand Canyon-Parashant National Monument
- Grand Staircase-Escalante National Monument
- Kanab Field Office
- St. George Field Office
- Utah State Office
- Vermilion Cliffs National Monument

National Forest Service
- Dixie National Forest
- North Kaibab Ranger District

National Park Service
- Bryce Canyon National Park
- Capitol Reef National Monument
- Cedar Breaks National Monument
- Grand Canyon National Park
- Pipe Spring National Monument
- Utah State Coordinator

U.S. Environmental Protection Agency Region VIII
U.S. Fish and Wildlife Service

State and Local Agencies and Governments

Coral Pink Sand Dunes State Park
Five County Association of Governments
Iron County Commissioners
Kane County Commissioners
Kane County Water Conservancy District
Mayor of Cedar City, UT
Mayor of Colorado City, AZ
Mayor of Hildale, UT
Mayor of Hurricane, UT
Mayor of Kanab, UT
Mayor of Kanarraville, UT
Mayor of LaVerkin, UT
Mayor of Leeds, UT
Mayor of New Harmony, UT
Mayor of Orderville, UT
Mayor of Rockville, UT
Mayor of St. George, UT
Mayor of Springdale, UT
Mayor of Virgin, UT
Springdale Planning Commission
Utah Department of Environmental Quality

Utah Department of Natural Resources
Utah Division of Air Quality
Utah Division of Drinking Water
Utah Division of Water Resources
Utah Division of Wildlife Resources
Utah Office of the Governor
Utah School and Institutional Trust Lands Administration
Utah State Clearinghouse
Utah State Historic Preservation Officer
Washington County Commissioners
Washington County Water Conservancy District

Indian Tribes

Goshute Indian Tribe
Hopi Tribe
Kaibab Paiute Tribe
Moapa Band Paiute Tribe
Navajo Tribe
Northern Ute Tribe
Paiute Indian Tribe of Utah
Pueblo of Zuni
San Juan Southern Paiute
Skull Valley Goshute
Southern Ute
Ute Mountain Ute
White Mesa Ute

Organizations

Back Country Horsemen of Utah
Daily Spectrum
Defenders of Wildlife
Garfield County News
Grand Canyon Trust
Grand Canyon Wildlands Council
National Audubon Society
National Parks and Conservation Association
National Trust for Historic Preservation
National Wildlife Federation
Salt Lake Tribune
Sierra Club
Southern Utah Wilderness Alliance
Southwest Forest Alliance
The Access Fund
The Nature Conservancy
The Wilderness Society
Wilderness Watch

REFERENCES

Aikens, C. 1965. Excavations in Southwest Utah. *University of Utah Anthropological Papers.* No. 76.

Alter, J.C., ed. 1942. "Journal of Priddy Meek's". Utah Historical Quarterly 10:145-223.

Atwood, D., J. Holland, R. Bolander, B. Franklin, D. House, L. Armstrong, K. Thorne and L. England. 1991. Utah: Threatened, Endangered, and Sensitive Plant Field Guide.

Belnap, Jayne, Julie H. Kaltenecker, Roger Rosentreter, John Williams, Steve Leonard and David Eldridge. 2001. Biological Soil Crusts: Ecology and Management. U. S. Bureau of Land Management, National Science and Technology Center, Technical Reference 1730-2, Denver, Colorado. 109 pp.

Bradley, Anne F. et al. 1992. Fire Ecology of Forests and Woodlands in Utah. USDA Forest Service General Technical Report INT-287, June 1992.

Brown, J.K. 1974. Handbook for inventorying downed material. General Technical Report INT-16, U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Brown, J. K., et. al. (1994). Comparing the prescribed natural fire program with presettlement fires in the Selway-Bitterroot Wilderness. *International Journal of Wildland Fire*. 4(3): 157–168.

Bureau of Economic Analysis, Regional Economic Information System. 1998.

Cedar City Economic Development. 2003.

Conner, Melissa A. and Susan M. Vetter. 1986. Archaeological Investigations at Zion National Park. *Midwest Archaeological Center Occasional Studies in Anthropology*, No. 19. National Park Service, Lincoln, Nebraska.

Delaney, D.K., Grubb, T.G., Beier, P., Pater, L. L., Reiser, M. H. 1999. Effects of helicopter noise on Mexican spotted owls. *Journal of Wildlife Management*. 63(1): 60-76.

Executive Office of the President, Council on Environmental Quality (CEQ). 1978. Regulations for implementing the procedural provisions of the National Environmental Quality Act. Code of Federal Regulations Title 40, Parts 1500-1508. Washington, D.C.

Executive Office of the President, CEQ. 1981. Forty most asked questions concerning CEQ's National Environmental Quality Act regulations (40 CFR 1500-1508). Federal Register 46 (55):18026-18038.

Floyd, M.L., W.H. Romme, and D.D. Hanna. 2000. Fire history and vegetation pattern in Mesa Verde National Park, Colorado, USA. *Ecological Applications* 10:1666-1680.

Gruell, G.E., L.E. Eddleman, and R. Jaindl. 1994. Fire history of the pinyon-juniper woodlands of Great Basin National Park. Oregon State University Cooperative Studies Unit. Cooperative Agreement No. 9000-8-0006, Subagreement No. 14. TR NPS/PNROSU/NRTR-94/01.

Hann, W.J. and Bunnell, D.L. In Press (2001). Fire and land management planning and implementation across multiple scales. Int. J. Wildland Fire 27p.

Hardy, C. C.; Menakis, J. P.; Long, D. G.; Brown, J. K.; Bunnell, D. L. 1998. Mapping historic fire regimes for the Western United States: integrating remote sensing and biophysical data. In: Proceedings of the seventh biennial Forest Service remote sensing applications conference; 1998 April 6–9; Nassau Bay, Texas. Bethesda, Maryland.

Heinselman, Miron L. 1981. Fire intensity and frequency as factors in the distribution and structure of Northern ecosystems. In: Fire regimes and ecosystem properties: proceedings of the conference; 1978 December 11–15; Honolulu, Hawaii. Gen Tech. Rep. WO-26. Washington, DC: U.S. Department of Agriculture, Forest Service: 7–57.

Hobbs, Chris and Micah Downing. 2003. The Natural Soundscape in Zion National Park, Wyle Report WR03-08. Wyle Acoustic Group, Wyle Laboratories, Arlington, Virginia.

Jenkins, M.J. 1995. Fire history determination in the mixed conifer/aspen community of Bryce Canyon National Park. Utah State University, National Park Service. Cooperative Studies Unit. Bryce Canyon National Park Files. Project UW #5/34080:2-4.

Jurale, J. and N. Witherall. 1984. National Register of Historic Places – Multiple Resources Nomination for Zion National Park.

Lentsch, L. D., M. J. Perkins, and H. Maddux. 1995. Virgin Spinedace Conservation Agreement and Strategy. Publication Number 95-13. Utah Division of Wildlife Resources, Salt Lake City, Utah. 31 pp.

Madany, M. H. and N.E. West. 1980. Fire History of Two Montane Forest Areas of Zion National Park. General Technical Report RM-81. Rocky Mountain Forest and Range Experiment Station, United States Department of Agriculture, Forest Service. 7 p.

Madany, M. H. and N.E. West. 1984. Vegetation of Two Relict Mesas in Zion National Park. *Journal of Range Management,* Volume: 37, Issue: 5, page(s) 456-461.

Mason, L.R. and V. Mortensen. 1977. Vegetation and soils of Zion National Park. Mimeo. Soil Conservation Service, Salt Lake City, Utah. 149 pp.

McKoy, Kathy and Robert Sontag. 1995. National Register of Historic Places – Multiple Resources Nomination for Zion National Park (Addendum) Floor of the Valley Road.

McNabb et al. 1996. Fire Resistance of Forest Species as Influenced by Root Systems. *Journal of Range Management,* Volume:22, Issue:2, page(s) 120-122.

Powell, J.W. 1879. Report on the lands of the arid region of the United States with a more detailed account of the land of Utah. 2nd. Ed. Government Printing Office, Washington , D.C. pp. 14-19.

St. George Area Chamber of Commerce. 2003.

Schmidt, K.M., et. al. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 41P. +CD.

Schroeder, Albert H. 1955. Archaeology of Zion Park. *University of Utah Anthropological Papers* No. 22.

Shilsky, A. 2003. Desired Future Conditions. In: Eckert, E. Gregory; Sexton, O Timothy; Hiebert, Ron; Ellsworth, Pat. Integrated Fire and Resource Management Planning. Training 2003 April 28-May 2; Northern Arizona University and National Park Service: DFC.

Sigler, W.F. and J.W. Sigler. 1996. *Fishes of Utah*. University of Utah, Salt Lake City, Utah.

Snow, L.A. 1911. Land Survey Notes. Book A-366. pp. 3-61. USDI-USGS. Available at: Bureau of Land Management State Office, Salt Lake City, Utah.

Stoffle, R.W., D.E. Austin, D.B. Halmo, and A.M. Phillips III. 1995. Ethnographic Overview and Assessment: Zion National Park, Utah and Pipe Spring National Monument, Arizona. Ms. on file, Rocky Mountain Regional Office, National Park Service, Denver, Colorado and Zion National Park, Springdale, Utah.

Stein, S.J. 1988. Fire History of the Paunsaugunt Plateau in Southern Utah. *Great Basin Naturalist* 48(1): 58-63.

Stewart, O.C. 1953. Why the Great Plains are treeless. *Colorado Quarterly* 2:40-49.

Swetnam, T.W., and C.H. Baisan. 1996. Historical fire regime patterns in the southwestern United States since A.D. 1700. In C.D. Allen (technical ed.), Fire effects in southwestern forests: Proceedings of the Second La Mesa Fire Symposium, Los Alamos, New Mexico, 1994, pp. 11-32. USDA Forest Service General Technical Report RM-GTR-286.

United States Department of Agriculture (USDA). Soil Conservation Service. 1977. Soil Survey of Washington County Area, Utah. 94 pp.

USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. 2004. Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/

United States Department of Agriculture, Forest Service Intermountain Region; U. S. Department of the Interior: National Park Service, Bureau of Land Management, Fish and Wildlife Service; Utah Natural Heritage Program: U. S. Environmental Protection Agency Region 8; Navajo Nation Natural Heritage Program; Skull Valley Goshute Tribe. 1991. *Utah Endangered, Threatened, and Sensitive plant Field Guide*.

United States Department of Commerce (USDC). Economics and Statistics Administration (ESA). 2000. U.S. Census Bureau 2000.

USDC. ESA. 2001. U.S. Census Bureau 2001.

USDC. ESA. 2003. U.S. Census Bureau 2003.

United States Department of the Interior, Department of Agriculture, Department of Energy, Department of Defense, Department of Commerce, Environmental Protection Agency, Federal Emergency Management Agency, and National Association of State Foresters. 2001. Review and Update of the 1995 Federal Wildland Fire Management Policy.

United States Department of the Interior (USDI), Fish and Wildlife Service (USFWS). 1994. Desert Tortoise (Mojave population) Recovery Plan. USFWS, Portland, Oregon.

USDI, USFWS. 1995a. Recovery Plan for the Mexican Spotted Owl: Vol. 1. Albuquerque, New Mexico.

USDI, USFWS. 1995b. Recovery Plan for the Virgin River Fishes. USFWS, Region 6, Denver Colorado.

USDI, USFWS. 1997. Notice of an Interagency Agreement for the Conservation of the Coral Pink Sand Dunes Tiger Beetle. Federal Register, Volume 62, No. 84. FR Doc. 97-11286.

USDI, USFWS. 2000. National Wetlands Inventory Maps. 20 USGS Quadrangles of enhanced NWI mapping of Zion National Park and vicinity.

USDI, USFWS. 2001a. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for *Astragalus holmgreniorum* (Holmgren milk-vetch) and Astragalus ampullarioides (Shivwits milk-vetch) Final Rule. Federal Register, Volume 66, No. 189, pages 49560-49567.

USDI, USFWS. 2001b. Final Designation of Critical Habitat for the Mexican spotted owl; 50 CFR Part 17, February 1, 2001.

USDI, USFWS. 2002. Colorado Pikeminnow *(Ptychocheilus lucius)* Recovery Goals: amendment and supplement to the Colorado Squawfish Recovery Plan. USFWS, Mountain-Prairie Region (6), Denver Colorado.

United States Department of the Interior (USDI), National Park Service (NPS). 1992. Zion National Park. Wildland Fire Management Plan.

USDI, NPS. 1998. Director's Order-28, Cultural Resource Management Guidelines. Washington, D.C.

USDI, NPS. 1999. Zion National Park. Wildlife monitoring reports.

USDI, NPS. 2001a. Director's Order-12 and Handbook, Conservation Planning, Environmental Impact Analysis, and Decision Making. Washington, D.C.

USDI, NPS. 2001b. Fire Monitoring Handbook. National Interagency Fire Center, Boise, Idaho.

USDI, NPS. 2001c. Management Policies 2001. NPS D1416. Washington, D.C.

USDI, NPS. 2001d. Zion National Park. Peregrine falcon management and monitoring information.

USDI, NPS. 2001e. Zion National Park. General Management Plan.

USDI, NPS. 2002a. Director's Order-77-1, Wetland Protection. Washington, D.C.

USDI, NPS. 2002b. Director's Order-18 and Reference Manual, Wildland Fire Management. Washington, D.C.

USDI, NPS. 2002c. Zion National Park. Statement for Management.

USDI, NPS. 2002d. Zion National Park. Wildland-Urban Interface Fuels Management Environmental Assessment/Finding of No Significant Impact.

USDI, NPS. 2003b. 2002 Backcountry Statistics. USDI – NPS, 2003. 4 pp.

USDI, NPS. 2003c. Zion National Park Geographic Information System (GIS) Program, Arc/Info 8.3 GIS Coverages and Summary Statistics, Resource Management and Research Division.

Utah Division of Wildlife Resources (UDWR). 2000. Desert Tortoise *(Gopherus agassizii)* Distribution Survey, Zion National Park. Publication Number 00-36.

UDWR. 2001. Kanab Ambersnail Distribution Survey in the East Fork of the Virgin River, Lower Parunuweap Canyon, Utah. Publication Number 01-29.

UDWR. 2003. Baseline Virgin Spinedace *(Lepidomeda mollispinis mollispinis)* Population Demographics in an Area Proposed for Floodplain Restoration and a Reference Reach, North Fork of the Virgin River, Zion National Park, Fall 2002.

Utah Smoke Management Plan. 2002.

Utah Travel Center. 2003.

Valdez, R. A., W. J. Massilch, R. Radant, and D. Knight. 1991. *Status of the Virgin spinedace (Lepidomeda mollispinis mollispinis) in the Virgin River Drainage, Utah*. BIO/WEST, Inc. Report No. PR-197-1.

Vose, J.M. 2000. Perspectives on using prescribed fire to achieve desired ecosystem conditions. In: Moswer, W. Keith; Moser, Cynthia F., eds. Fire and forest ecology: innovative silviculture and vegetation management; Tall Timbers fire ecology conference proceeding, no. 21; 1998 April 14-16; Tallahassee, Florida. Tallahassee, Florida: Tall Timbers Research Station: 12-17.

Walstad. 1990. Effects of Fire on Wildlife Communities. *Proceedings of the Symposium,* August 1-5, Palo Alto, CA. General Technical Report WO3.

Wauer, Roland. 1997. *Birds of Zion National Park and Vicinity*. Utah State University. Logan, Utah.

Welsh, Stanley L. 1988. Zion National Park threatened and endangered and exotic plant surveys; final report 1987-1988. Endangered Plant Studies, Inc. Orem, Utah. 185 p.

Welsh, S.L., D.N. Atwood, S. Goodrich and L. Higgins. 1993. *A Utah Flora*. Brigham Young University. Provo, Utah.

Welsh, S.L., D.N. Atwood, and J.L. Reveal. 1975. Endangered, threatened, extinct, endemic, and rare or restricted Utah vascular plants. *Great Basin Naturalist*. Volume: 35, Issue: 4. Page(s) 327-376.

West, N.E., and W.C. Loope. 1977. Annual report to Zion National Park on studies of fire frequency in backcountry ecosystems of Zion National Park. Zion National Park, Utah.

West, N. E., and M. H. Madany 1981. Fire History of the Horse Pasture Plateau. Final Report USDI Contract No. CX-1200-9-B048. USU. 77, 191, & 224p.

Wight, D.W. 1989. Fire History, Residential Study Area in Bryce Canyon National Park. Bryce Canyon National Park Files.

Zimmerman, G.T., and Bunnell, D.L. 1998. Wildland and Prescribed Fire Management Policy: Implementation Procedures Reference Guide. National Park Service, USDA Forest Service, Bureau of Indian Affairs, US Fish and Wildlife Service, and Bureau of Land Management.

Zion Canyon Chamber of Commerce. 2003.

Page Intentionally left Blank

GLOSSARY

Annual Plant – A plant growing from seed, producing flowers and seeds, and dying the same year.

Appropriate Management Response – Specific actions taken in response to a wildland fire to implement protection and/or fire use objectives. This term is a new term that does not replace any previously used term.

Appropriative Water Rights – Water Rights administered by the state for the use of water by diverting it from the natural channel and applying it to state recognized beneficial uses (e.g. irrigation, domestic or municipal water supply). Among their attributes are date of appropriation, point of diversion, place of use, amount and type of use. (Zion has purchased appropriative water rights from private owners as the Federal Government acquired lands.)

Backcountry – Zion backcountry constitutes most of the undeveloped area of the park, where no roads or substantial human-made structures exist. Much of Zion's backcountry, however, does contain maintained trails. Primary backcountry travel is by foot, and on specified trails, by horseback. Camping is regulated in the backcountry: in some areas camping is allowed nearly anywhere, while in other areas camping is only permitted in designated campsites.

Base Flow – River or spring flow that is low and steady, typically from the discharge of groundwater and not as a result of recent precipitation.

Biological Soil Crusts – Where the soil surface is bound together by a community of organisms that can include cyanobacteria, algae, fungi, mosses and lichens. These create a soft crust at the soil surface that is resistant to raindrop impact, erosion from wind and water, and its roughness greatly increase the soil's ability to capture and hold water.

Canyoneering – Hiking and rappelling through narrow canyons. In Zion, permits are issued for canyoneering routes requiring the use of rappelling equipment.

Class I Area – Lands designated through the Clean Air Act, including National Parks and Wilderness, that are given the highest protection of existing air quality (prevention of significant deterioration), and where visibility and other air quality related values are protected.

Cumulative Impacts – The impacts of cumulative actions - includes impacts of actions in the past, the present, and the reasonable foreseeable future.

Defensible Space – An area either natural or manmade where material capable of causing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and the loss to life, property, or resources. In practice, "defensible space" is defined as an area a minimum of 30 feet around a structure that is cleared of flammable brush or vegetation.

Desired Future Conditions – The goals or end results park managers are striving to achieve. Desired conditions can be set for park resources, visitor experiences, management activities, and facilities. Desired conditions reflect the park's purpose and mission goals, and ensure that Zion's resources are conserved and quality experiences are provided.

Direct Effect – An impact that occurs as a result of the proposed action or alternative in the same place and at the same time as the action.

Ecosystem Sustainability – Perpetuation of the biological, cultural, and physical processes such that dependent resources are maintained in high condition within a natural range of variability.

Environmental Assessment – Environmental assessments were authorized by the National Environmental Policy Act (NEPA) of 1969. They are concise, analytical documents prepared with public participation that determine if an Environmental Impact Statement is needed for a particular project or action. If an environmental assessment

determines an environmental impact statement is not needed, the environmental impact statement becomes the document allowing agency compliance with NEPA requirements.

Environmental Impact Statement – Environmental impact statements were authorized by the National Environmental Policy Act (NEPA) of 1969. Prepared with public participation, they assist decision makers by providing information, analysis and an array of action alternatives, allowing managers to see the probable effects of decisions on the environment. Generally, environmental impact statements are written for large-scale actions or geographical areas.

Ethnographic Resources – These resources have importance to American Indians and descendants of early pioneers and may include archaeological sites, geographic areas, or natural resources such as springs/seeps, vegetation, wildlife, or mineral deposits.

Fecal Bacteria – A group of bacteria growing in abundance in the gut of warm-blooded animals, including humans, that are used as an indicator of fecal contamination of water.

Fire Break – A natural or constructed barrier used to stop or check fires that may occur, or to provide a control line from which to work.

Fire Regime – Refer to Historical Natural Fire Regime.

Fire Regime Current Condition Class - A qualitative measure describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. Data typically shows the degree of departure from historical fire regimes. The classification system includes three current condition classes. 1 – Fire regimes are within an historical range, and the risk of losing key ecosystem components is low. 2 – Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. 3 – Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. (See also historical natural fire regime)

Federal Reserved Water Rights – Water Rights associated with lands by virtue of their withdrawal by the Congress of the United States for Specific Purposes. The use and amount of water is that necessary to meat the purposes of the reservation, which may differ from state appropriative uses, and the date of appropriation is the date of withdrawal.

Fire Management Areas (FMA) – A sub-geographic area within an FMU that represents a pre-defined ultimate acceptable management area for a fire managed for resource benefits. This predefined area can constitute a Maximum Manageable Area (MMA) and is useful for those units having light fuel types conducive to very rapid fire spread rates. Pre-definition of these areas removes the time-lag in defining an MMA after ignition and permits pre-planning of the fire area, identification of threats to life, property, resources, and boundaries, and identification of initial actions.

Fire Management Plan (FMP) – A strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. The plan is supplemented by operational plans such as preparedness plans, preplanned dispatch plans, prescribed fire plans and prevention plans.

Fire Management Unit (FMU) – Any land management area definable by objectives, topographic features, access, values-to-be-protected, political boundaries, fuel types, or substantial fire regimes, etc., that sets it apart from management characteristics of an adjacent unit. FMUs are delineated in Fire Management Plans (FMP). These units may have dominant management objectives and pre-selected strategies assigned to accomplish these objectives.

Flash Flood – A flood that arrives with such rapidity that escape is difficult or impossible.

Floodplain – Part of a river channel that is inundated only during time of high flow. A 100-year floodplain is the area inundated by a flood that has a 1% chance of occurring in any given year, or occurs on average once every 100 years. Floods of this magnitude occur frequently enough to pose a serious threat to facilities and people.

Fuel – Combustible material. Includes, vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees that feed a fire.

Fuel Type – An identifiable association of fuel elements of a distinctive plant species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.

Fuel Reduction – manipulation, including combustion of fuels to reduce the likelihood of ignition and/or to lesson potential damage and resistance to control.

Hazard Reduction – Any treatment of a hazard that reduces the threat of ignition and fire intensity or rate of spread.

Herbicide – Any chemical substance used to control plant growth.

Historical Natural Fire Regime - Present definition being defined nationally as conditions existing before extensive pre-Euro-American settlement (pre-1900); conditions reflect the typical fire frequencies and effects that evolved in the absence of fire suppression. Fire frequency and severity measures were used to determine the departure from historical conditions. These data are not exact reconstructions of historical conditions.
The classification system includes five historical fire regimes. Fire Regime I (0- to 35-year frequency, low severity) is found primarily in forests that experience frequent, low-severity, non-lethal surface fires. Fire Regime II (0- to 35-year frequency, stand-replacement severity) is found primarily in grass and shrub lands. Fire Regimes III (35- to 100+ year frequency, mixed-severity), IV (35- to 100+ year frequency, stand replacement severity), and V (200+ year frequency, stand-replacement severity) can occur in any vegetation type.

Inholding – Tracts of land in private ownership within the boundary of the park. These were in private ownership before designation of park lands in that area, and retain preexisting property rights and land uses.

Impact Topics – Specific natural, cultural, or socioeconomic resources that would be affected by the proposed action or alternatives (including no action). The magnitude, duration, and timing of the effect to each of these resources are evaluated in the impact section of the environmental assessment.

Indirect Impact – Reasonably foreseeable impacts that occur removed in time or space from the proposed action. These "downstream" impacts, future impacts, or the impacts of reasonably expected connected actions (e.g., growth in an area after a highway is completed).

Issue(s) – In NEPA, issues are environmental, social, and economic problems or effects that may occur of the proposed action or alternatives (including no action) are implemented or continue to be implemented.

Light-on-the-Land Equipment- Tracked vehicles designed to exert minimal ponds per square inch on the land surface and therefore do not cause extreme rutting or compaction.

Litter – Top layer of the forest, scrubland, or grassland floor, directly above the fermentation layer composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves or needles, little altered in structure by decomposition.

Management Zones – In the Visitor Experience and Resource Protection Plan, identify how different areas in the park will be managed to achieve a combination of desired conditions. Each zone represents a unique combination of physical, biological, social, and managerial conditions.

Mesa – A flat-topped mountain or plateau bounded on at least one side by a steep cliff.

National Environmental Policy Act (NEPA) – NEPA is the basic national law for protection of the environment, passed by Congress in 1969. It sets policy and procedures for environmental protection, and authorizes Environmental Impact Statements and Environmental Assessments to be used as analytical tools to help federal managers make decisions.

Natural Sound and Soundscape – Any sounds produced by nature, such as the wind in the trees, songs of birds, flow of water in rivers and streams, etc. Unnatural sound would include any sounds produced by people or their devices, such as human voices, vehicles, and motorized tools.

Non-native Plant – A plant that is not native to the area, exotic.

Perennial Plant – Plants living more than two years.

Plateau – An elevated, relatively flat region commonly limited on at least one side by an abrupt decent to lower land.

Prescribed Fire – Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition. This term replaces management ignited prescribed fire.

Prescribed Fire Plan – A plan required for each fire application ignited by managers. It must be prepared by qualified personnel and approved by the appropriate Agency Administrator prior to implementation. Each plan will follow specific agency direction and must include critical elements described in agency manuals. Formats for plan development vary among agencies, although the plans cover the same topics.

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.

Prior Appropriation – The concept that is the basis of water rights in most western states whereby the first water user to apply the water to a state-defined beneficial use has the most powerful right. Water is then distributed based on the "appropriation date" of each water right, with the earliest date receiving all of its entitlement before more junior users receive any.

Regional Haze – A reduction in visual range caused by long-range transport of particulate matter. An increase in haze reduces the ability to see distant features, and causes a loss of detail and color saturation in close features. Rehabilitation: The activities necessary to repair damage or disturbance caused by wildland fires or the fire suppression activity.

Research Natural Areas – Field ecological areas designated primarily for research and education and/or to maintain biological diversity.

Retardant – A substance or chemical agent that reduces the flammability of combustibles.

Riparian – Adjacent to, or living on, the bank of a river, or sometimes a lake or pond.

Scoping – Internal NPS decision-making on issues, alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, lead and cooperating agency roles, available references and guidance, defining purpose and need, and so forth. External scoping is the early involvement of the interested and affected public.

Seral – One of a series of plant communities that follows another in time on a specific site – early, mid, late.

Slickrock – Flat areas or, more commonly, slopes with large exposures of bare rock. This is typically on exposures of Navajo sandstone in Zion.

Soil Horizon – A layer within a soil profile that is distinct due to differences in texture, color, structure or the amount of organic matter. These develop due to the weathering of minerals in the soil, or the removal and deposition of fine particles or water-soluble minerals in the soil column.

Suppression – All the work of extinguishing or containing a fire, beginning with its discovery.

Watershed – The area drained by a river or river system.

Wildland – Any natural landscape not maintained for buildings, road, fence or other human development.

Wildland Fire – Any non-structural fire, other than a prescribed fire, that occurs in wildland. This term encompasses fire previously called both wildland fire and prescribed natural fire.

Wildland Fire Implementation Plan (WFIP) – A progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response for a wildland fire. A full WFIP consists of three stages. Different levels of completion may occur for differing management strategies (i.e., fires managed for resource benefits will have two - three stages of the WFIP completed while some fires that receive a suppression response may only have a portion of Stage I completed).

Wildland Fire Situation Analysis (WFSA) – A decision-making process that evaluates alternative management strategies against selected safety, environmental, social, economic, political, and resource management objectives.

Wildland Fire Use – The management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in pre-defined geographic areas outlined in Fire Management Plans. Operational management is described in the Wildland Fire Implementation Plan (WFIP). Wildland fire use is not to be confused with "fire use," which is a broader term encompassing more than just wildland fires

Wildland Urban Interface – The line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

Page Intentionally Left Blank

ACRONYMS

BAER	Burn Area Emergency Rehabilitation
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CC	Condition Class
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon Monoxide
dBA	A-Weighted Decibels
DFC	Desired Future Condition
DO	Director's Order
EA	Environmental Assessment
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FMP	Fire Management Plan
FMU	Fire Management Unit
FR	Fire Regime
GIS	Geographic Information System
GMP	General Management Plan
GPS	Global Positioning System
LCS	List of Classified Structures
MIST	Minimum Impact Suppression Techniques
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_X	Oxides of Nitrogen
NPS	National Park Service
NRHP	National Register of Historic Places
NVCS	U.S. National Vegetation Classification System
RNA	Research Natural Area
SHPO	State Historic Preservation Officer
SO_X	Oxides of Sulfur
UDWR	Utah Division of Wildlife Resources
USBOR	U.S. Bureau of Reclamation
USC	United States Code
USDA	U.S. Department of Agriculture
USDC	U. S. Department of Commerce
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WFIP	Wildland Fire Implementation Plan
WFSA	Wildland Fire Situation Analysis
WUI	Wildland Urban Interface
ZNHA	Zion Natural History Association

Page Intentionally Left Blank

Appendix A
Summary of Fires in Zion National Park 1931-2000

Year	Cause		Acres	Prescribed Fires		Wildfire for Resource Be	
	Lightning	Human		Number	Acres	Number	Acres
1931	1	2	0.01	0	0	0	0
1932	1	0	30.0	0	0	0	0
1933	1	0	0.13	0	0	0	0
1934	1	0	32.0	0	0	0	0
1935	0	1	9.1	0	0	0	0
1935	1	0	0.05	0	0	0	0
1937	1	0	0.02	0	0	0	0
1938	0	1	1.5	0	0	0	0
1939	3	0	2.5	0	0	0	0
1940	1	1	2.0	0	0	0	0
1941	3	3	1.85	0	0	0	0
1942	5	5	29.0	0	0	0	0
1943	2	1	301.7	0	0	0	0
1944	3	1	5.0	0	0	0	0
1945	3	1	0.19	0	0	0	0
1946	8	6	86.15	0	0	0	0
1947	1	0	0.1	0	0	0	0
1948	6	5	36.06	0	0	0	0
1949	7	3	1.5	0	0	0	0
1950	4	0	1.0	0	0	0	0
1951	6	0	69.15	0	0	0	0
1952	2	1	1.55	0	0	0	0
1953	2	1	0.88	0	0	0	0
1954	6	4	12.4	0	0	0	0
1955	5	2	4.6	0	0	0	0
1956	7	2	13.5	0	0	0	0
1957	2	0	0.5	0	0	0	0
1958	1	1	417.0	0	0	0	0
1959	7	2	302.0	0	0	0	0
1960	7	0	1.0	0	0	0	0
1961	8	5	8.1	0	0	0	0
1962	6	2	22.4	0	0	0	0
1962	4	0	4.25	0	0	0	0
1964	2	0	28.0	0	0	0	0
1965	3	1	3.2	0	0	0	0
1966	5	0	5.0	0	0	0	0
1967	4	0	18.1	0	0	0	0
1968	5	4	4.85	0	0	0	0
1969	0	0	0.0	0	0	0	0
1970	8	0	4.0	0	0	0	0
1971	4	0	1.0	0	0	0	0
1972	2	8	8.9	0	0	0	0
1973	7	1	40.0	0	0	0	0
1974	7	1	7.2	0	0	1	40.0
1975	7	3	4.7	0	0	0	0
1976	6	5	9.5	0	0	0	0
1977	11	2	76.4	0	0	0	0
1978	14	1	68.9	0	0	0	0
1979	3	5	28.5	0	0	0	0
1980	13	3	162.2	0	0	0	0
1981	13	2	10.2	0	0	0	0

Appendix A
Summary of Fires in Zion National Park 1931-2000

Year	Cause		Acres	Prescribed Fires		Wildfire for Resource Be	
	Lightning	Human		Number	Acres	Number	Acres
1982	5	3	802.5	2	23.0	0	0
1983	3	0	1.2	0	0	0	0
1984	3	2	21.2	0	0	7	26.4
1985	4	3	0.8	1	2	11	16.4
1986	9	2	711.3	2	11.5	4	8.4
1987	7	2	8.1	0	0	1	22.9
1988	16	1	1,483.7	0	0	3	151.6
1989	2	4	14.3	0	0	0	0
1990	5	2	1.3	1	3	0	0
1991	21	7	103.0	1	1	0	0
1992	13	7	119.0	4	460.5	0	0
1993	8	2	0.7	0	0	1	0.1
1994	25	8	14.4	2	37.0	1	0.2
1995	9	4	2.2	4	109.0	4	7.3
1996	24	3	5,851.0	5	163.0	5	2,105.5
1997	7	3	29.3	8	1,360.0	5	2.3
1998	11	6	68.4	6	508.0	5	0.5
1999	9	0	14.0	6	2,334.1	9	500.6
2000	4	14	98.0	4	605.0	2	24.0
Total	422	147	9,292.32	46	5,671.1	58	2,865.2

Data from SACS internet site for *1935 (total fire column only), 1965 - 1967 and 1972 - 2000*.
Statistics on number of lightning fires and acres were obtained from "Frequency and Role of Fire in Ecosystems of Zion National Park" (West and Loope), Logan, Utah, December 1, 1977 for the years *1931 - 1964 and 1968 - 1971*.

Appendix B
Zion National Park Legislation

- Mukuntuweap National Monument, Utah – Proclamation No. 877 – July 31, 1909 (36 Stat. 2498)
- Zion National Monument, Utah – Proclamation No. 1435 – Mar. 18, 1918 (40 Stat. 1760)
- An Act to establish the Zion National Park in the State of Utah, approved November 19, 1919 (41 Stat. 356)
- Excerpt from "An Act to establish the Utah National Park in the State of Utah," approved June 7, 1924 (43 Stat. 593)
- Executive Order, March 24, 1925, [No. 4181], Utah
- An Act for the relief of the town of Springdale, Utah, approved May 28, 1928 (45 Stat. 787)
- Executive Order, January 28, 1929, [No. 5037], Utah
- An Act to add certain lands to the Zion National Park in the State of Utah, and for other purposes, approved June 13, 1930 (46 Stat. 582)
- Zion National Monument Establishment - Proclamation No. 2221 - January 22, 1937 (50 Stat. 1809)
- An Act to authorize the Secretary of the Interior to convey certain property to Washington County, Utah, and for other purposes, approved June 3, 1941 (55 Stat. 237)
- An Act to amend the description of the area affected by the Act of May 28, 1928, entitled "An Act for the relief of the town of Springdale, Utah," and for other purposes, approved July 8, 1943 (PL 122-78th Congress)
- An Act to Include the present area of Zion National Monument within Zion National Park, in the State of Utah, and for other purposes, approved July 11, 1956 (70 Stat. 527)
- An Act to revise the boundaries of the Zion National Park in the State of Utah, and for other purposes, approved February 20, 1960 (74 Stat. 4)
- An Act to provide for increases in appropriation ceilings and boundary changes in certain units of the National Park System, and for other purposes, October 21, 1976 (90 Stat. 2732) (PL 94-578)

Mukuntuweap National Monument, Utah
By the President of the United States of America
A Proclamation
[No. 877 – July 31, 1909 – 36 Stat. 2498]

Whereas, the Mukuntuweap Canyon, through which flows the North Fork of the Rio Virgin, or Zion River, in Southwestern Utah, is an extraordinary example of canyon erosion and is of the greatest scientific interest, and it appears that the public interest would be promoted by reserving it as a National monument, with such other land as may be necessary for its protection;

Now, therefore, I, William H. Taft, President of the United States of America, by virtue of the power in me vested by Section 2 of the Act of Congress approved June 8, 1906, entitled, "An Act for the Preservation of American Antiquities", do hereby set aside, as the Mukuntuweap National Monument, the Mukuntuweap Canyon of the North Fork of the Rio Virgin, or Zion River, embracing sections three, four, five, six, eight, nine, ten, fourteen, fifteen, sixteen, twenty-one, twenty-two, twenty-three, twenty-six, twenty-seven, twenty-eight, thirty-three, and thirty-four, Township forty South, Range ten, and all of the said canyon of the Rio Virgin, or Zion River, in Township forty-one South, Range ten, all west of the Salt Lake Meridian, Utah, as shown upon the diagram hereto attached and made a part of this proclamation.

Warning is hereby expressly given to all unauthorized persons not to appropriate, injure or destroy any feature of this National Monument, or to locate or settle upon any of the lands reserved by this proclamation.

In witness whereof, I have hereunto set my hand and caused the seal of the United States to be affixed. [seal]

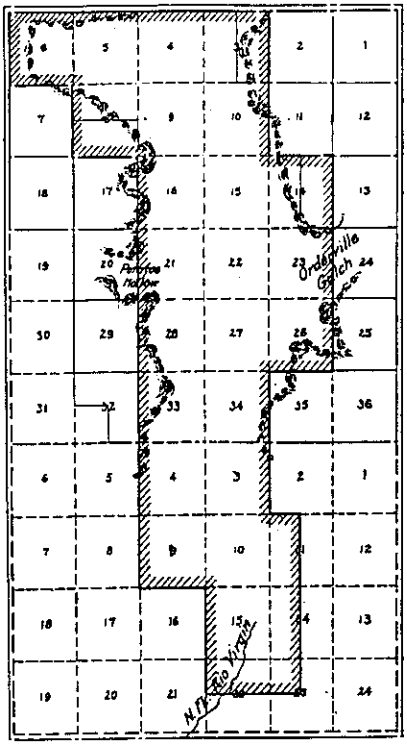
Done at the city of Washington this 31st day of July, in the year of out Lord one thousand nine hundred and nine, and of the Independence of the United States the one hundred and thirty-fourth.

Wm. H. Taft
By the President:
Huntington Wilson, Acting Secretary of State

Appendix B
Zion National Park Legislation

MUKUNTUWEAP
NATIONAL MONUMENT

Embracing Sections 3,4,5,6,8,9,10,14,15,16,21,22, 23, 26, 27, 28, 33 and 34 in T. 40 S. R. 10; and all of the Mukuntuweap canyon in T. 41 S. R10 all west of the Salt Lake Meridian, Utah



DEPARTMENT OF THE

INTERIOR

General Land Office

Fred Dennett, Commissioner

Appendix B
Zion National Park Legislation

Zion National Monument, Utah
By the President of the United States of America
A Proclamation
[No. 1435 – Mar. 18, 1918 – 40 Stat. 1760]

Whereas, It has been established by the research of competent observers that certain lands directly bordering upon the Mukuntuweap National Monument, reserved by proclamation dated July 31, 1909, said monument and adjacent lands being in the State of Utah, contain many natural features of unusual archeologic, geologic, and geographic interest, unknown at the time the monument was created.

And whereas, the archeologic features pertain to the prehistoric races of America and to ancestral Indian tribes,

And whereas, the geologic features include craters of extinct volcanoes, fossiliferous deposits of unusual nature, and brilliantly colored strata of unique composition, among which are some believed to be the best representatives in the world of a rare type of sedimentation,

And whereas, the features of geographic interest include a labyrinth of remarkable canyons with highly ornate and beautifully colored walls, in which are plainly recorded the geologic events of past ages.

And whereas, it appears that the entire area herein referred to should be preserved intact for the purpose of scientific research and for the enjoyment and enlightenment of the public.

And whereas, the canyon of the North Fork of the Virgin River, the principal natural feature of geologic and geographic interest included within the boundaries of the said Mukuntuweap National Monument, was named "Zion Canyon" by Mormon settlers many years before the name "Mukuntuweap" was given to this region because it was regarded as a safe refuge in the event of Indian attacks on neighboring settlements,

And whereas, the name "Zion" is still applied to this region to the exclusion of the name "Mukuntuweap,"

And whereas, it is desirable that the national monument embracing said region shall bear the generally accepted name "Zion."

Now, therefore, I, Woodrow Wilson, President of the United States of America, by virtue of the power and authority in me vested by section two of the Act of Congress entitled "An Act for the preservation of American antiquities," approved June 8, 1906 (34 Stat. 225), do proclaim that there are hereby reserved from all forms of appropriation under the public-land laws, and set apart as the Zion National Monument, certain tracts of land particularly described as follows, to wit, all of township forty south, range ten west; all of township forty south, range ten and one-half west, with the exceptions of sections one and two; sections one, eleven, twelve, thirteen, fourteen, twenty-three, twenty-four, twenty-five, twenty-six, thirty-five, and thirty-six of township forty south, range eleven west; sections one, two, three, ten, eleven, twelve, thirteen, fourteen, fifteen, twenty-two, twenty-three, twenty-four, twenty-five, twenty-six, and twenty-seven of township forty-one south, range eleven west; and sections one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, twenty, the north half and southeast quarter of twenty-two, twenty-three, twenty-four, twenty-five, twenty-six, the south half and northeast quarter of twenty-seven, thirty, thirty-four, thirty-five and thirty-six of township forty-one south, range ten west, all west of the Salt Lake Meridian in the State of Utah, which tracts include the lands embraced in the Mukuntuweap National Monument as reserved by the proclamation of July 31, 1909, and that the boundaries of said Zion National Monument are as shown on the diagram hereto attached and made part hereof.

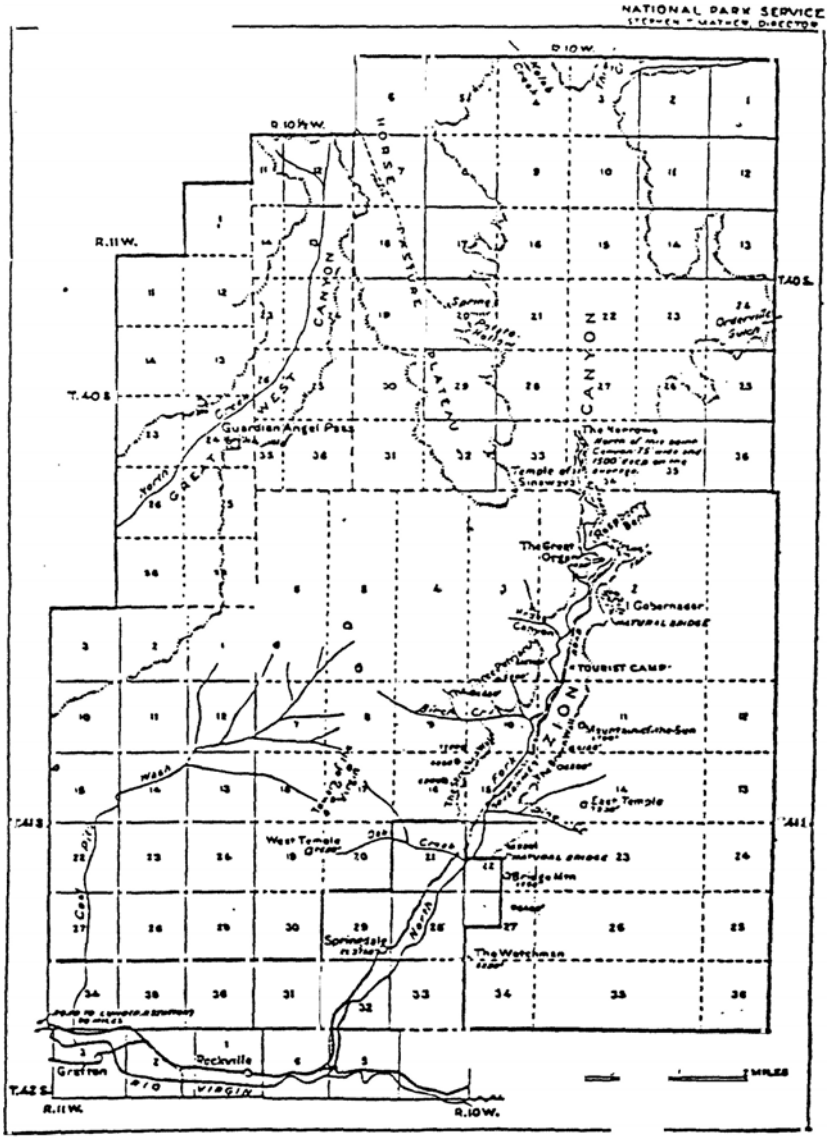
Warning is hereby given to all unauthorized persons not to appropriate or injure any natural feature of this monument or to occupy, exploit, settle, or locate upon any of the lands reserved by this proclamation.

The Director of the National Park Service, under the direction of the Secretary of the Interior, shall have the supervision, management, and control of this monument, as provided in the Act of Congress entitled "An Act to establish a National Park Service, and for other purposes," approved August 25, 1916 (39 Stat. 535).

In witness hereof, I have hereto set my hand and caused the seal of the United States to be affixed. [seal]

Done in the District of Columbia this eighteenth day of March, in the year of our Lord one thousand nine hundred and eighteen, and of the Independence of the United States of America the one hundred and forty-second.

Woodrow Wilson
By the President:
Robert Lansing, Secretary of State



Zion National Monument
Department of the Interior, National Park Service
Washington County, UTAH
Franklin W. Lane, Secretary

Appendix B
Zion National Park Legislation

An Act to establish the Zion National Park in the State of Utah, approved November 19, 1919 (41 Stat. 356)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Zion National Monument, in the county of Washington, State of Utah, established and designated as a national monument under the act of June 8, 1906, entitled "An Act for the preservation of American antiquities," by Presidential proclamation of July 31, 1909, and March 18, 1918, is hereby declared to be a national park and dedicated as such for the benefit and enjoyment of the people, under the name of the Zion National Park, under which name the aforesaid national park shall be maintained by allotment of funds heretofore or hereafter appropriated for the national monuments, until such time as an independent appropriation is made therefore by Congress. (USC, title 16, 5CC, § 344)

Sec. 2. That the administration, protection, and promotion of said Zion National Park shall be exercised under the direction of the Secretary of the Interior by the National Park Service, subject to the provision of the Act of August 25, 1916, entitled "An Act to establish a National Park Service, and for other purposes," and Acts additional thereto or amendatory thereof. (USC, title 16, § 345)

Excerpt from "An Act to establish the Utah National Park in the State of Utah," approved June 7, 1924 (43 Stat. 593)

The Secretary of the Interior is hereby authorized to exchange, in his discretion, alienated lands in Zion National Park for unappropriated and unreserved public lands of equal value and approximately equal area in the State of Utah outside of said park. (USC, title 16, § 346)

Executive Order, March 24, 1925, [No. 4181], Utah

Under authority of the act of Congress approved June 25, 1910 (36 Stat. 847), as amended by the act of August 24, 1912 (37 Stat. 497), it is hereby ordered that the public lands in the following described area in Utah be, and the same are hereby, temporarily withdrawn subject to the conditions, provisions and limitations of said acts, for the purpose of classifying such lands and pending enactment of appropriate legislation for their proper disposition:

Salt Lake Meridian
In unsurveyed T 42 S, R 9½ W, what will probably be when surveyed Secs. 5, 6, 7, and 8;
In T 42 S, R 10 W, SW¼ sec. 3, NW¼ Sec. 10, and unsurveyed land which will probably be when surveyed all secs. 1 and 2, N½ and SE ¼ Sec 3, NE¼ and S½ sec. 10, all secs. 11 and 12.

Calvin Coolidge, The White House

An Act for the relief of the town of Springdale, Utah, approved May 28, 1928 (45 Stat. 787)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior is hereby authorized and directed, under such reasonable regulations as he may prescribe, to grant permission to the town of Springdale, Utah, to divert through such piping facilities as may be necessary, for domestic and other uses within the limits of said town of Springdale, Utah, water from certain springs in the Zion National Park, Utah, situated at the head of what is known as Oak Creek, which crosses the main highway about one-half mile below the park boundary, and located in approximately section 20, township 41 south, range 10 west, Salt Lake meridian.

Executive Order, January 28, 1929, [No. 5037], Utah

It is hereby ordered under authority of the Act of Congress approved June 25, 1910 (36 Stat. 847), as amended by the Act of August 24, 1912 (37 Stat. 497), that the public lands in the following described area in the State of Utah be, and the same are hereby, temporarily withdrawn from settlement, location, sale or entry, subject to the conditions and limitations of said acts, for classification and pending determination as to the advisability of adding same to the Zion National Park:

Salt Lake Meridian

What will probably be when surveyed, the NE ¼ of Section 4, T 42 S, R 10 W, and the E ½ of the E ½ of Section 33, and the E ½ E ½ SE ¼ of Section 28, T 41 S, R 10 W.
What will probably be when surveyed, all of Sections 5, 6, 7, 8, 17 and 18, T 42 S, R 9 W
SW ¼ of Section 22, the NW ¼ of Section 27, and all of Section 21, T 41 S, R 10 W.

This order shall continue in full force and effect unless arid until revoked by the President or by act of Congress.

Calvin Coolidge, The White House

An Act to add certain lands to the Zion National Park in the State of Utah, and for other purposes, approved June 13, 1930 (46 Stat. 582) (PL 351)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That sections 7, 17, 18, 19, 20, 29, 30, 31, and 32, township 41 south, range 9 west; unsurveyed sections 5, 6, 7, 8, 17, and 18, township 42 south, range 9 west; unsurveyed sections 5, 6, 7, and 8, township 42 south, range 9½ west; unsurveyed sections 1 and 2, and the north half and southeast quarter section 3; northeast quarter section 4, east half section 10, sections 11 and 12, township 42 south, range 10 west; all of section 21, southwest quarter section 22, northwest quarter section 27, southeast quarter unsurveyed section 28; east half unsurveyed section 33, township 41 south, range 10 west; and all of sections 34, 35, and 36, township 41 south, range 11 west, all with reference to the Salt Lake meridian, be, and the same are hereby, added to and made part of Zion National Park in the State of Utah, subject to all laws and regulations applicable to and governing said park. (USC, 6th supp., title 16, § 346a.)

Zion National Monument
Establishment: Proclamation (No. 2221) of January 22, 1937

By the President of the United States of America
A Proclamation
[No. 2221 – January 22, 1937 – 50 Stat. 1809]

Whereas certain public lands in the State of Utah contain volcanic phenomena of unusual scientific value, and have situated thereon various other objects of geological and scientific interest; and

Whereas it appears that it would be in the public interest to reserve such land as a national monument, to be known as the Zion National Monument.

Now, therefore, I, Franklin D. Roosevelt, President of the United States of America, under and by virtue of the authority vested in me by section 2 of the act of June 8, 1906, ch. 3060, 34 Stat. 225 (USC, title 16, § 431), do proclaim that, subject to all valid existing rights, the following-described lands in Utah are hereby reserved from all forms of appropriation under the public-land laws and set apart as the Zion National Monument:

Salt Lake Meridian
T39S, R10W, sec. 31, lots 4 to 14, and 19 to 30, inclusive.
T40S, R10½W, sec. 1 and unsurveyed fractional sec. 2.
T38S, R11W, secs. 31, 32, and 33.
T39S, R11W, secs. 4 to 9, and 16 to 21, inclusive, partly surveyed; sec. 24, NE¼ and S½; secs. 25 to 29, and 33 to 36, inclusive.
T40S, R11W, secs. 2, 3, 4, 9, 10, 15, 16, 21, 22, 27, 28, 33, and 34.
T41S, R11W, sec. 4; sec. 5, E½; sec. 8, NE¼; secs. 9, 16, and 21.
T38S, R12W, sec. 10, lots 3 to 10, inclusive; sec. 11, S½; sec. 12, S ½; secs. 13, 14, and 15; sec. 21, E½; secs. 22 to 28, inclusive; sec. 29, lot 1 and lots 3 to 8, inclusive; secs 33 to 36, inclusive.
T39S, R12W, secs. 1 to 4, and 9 to 15, inclusive, partly unsurveyed; sec. 16, E½; secs. 22, 23, and 24, partly unsurveyed, containing approximately 49,150 acres.

Warning is hereby expressly given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of this monument and not to locate or settle upon any of the lands thereof.

Appendix B
Zion National Park Legislation

The Director of the National Park Service, under the direction of the Secretary of the Interior, shall have the supervision, management, and control of this monument as provided in the act of Congress entitled "An Act to Establish a National Park Service, and for other purposes", approved August 25, 1916 (ch. 408, 39 Stat. 535, USC, title 16, § 1 and 2), and acts supplementary thereto or amendatory thereof.

The reservation made by this proclamation supersedes as to any of the above-described lands affected thereby the temporary withdrawals for classification and other purposes made by Executive Orders No. 5573 of March 7, 1931, and No. 6910 of November 26, 1934, as amended, and Executive Order of April 17, 1926, creating Public Water Reserve No. 107.

In witness whereof, I have hereunto set my hand and caused the seal of the United States to be affixed. [seal]

Done at the City of Washington, this 22nd day of January, in the year of our lord nineteen hundred and thirty-seven and of the Independence of the United States of America the one hundred and sixty-first.

Franklin D. Roosevelt

By the President: Cordell Hull, The Secretary of State

An Act to authorize the Secretary of the Interior to convey certain property to Washington County, Utah, and for other purposes, approved June 3, 1941 (55 Stat. 237)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior, in his discretion, is hereby authorized to convey, by quitclaim deed to Washington County, Utah, of the authorized agents or representatives of said county, certain land in improvements thereon, said land being described as follows:

Salt Lake Meridian
A part of lot 1 in block 9, and a part of lot 2 in block 3 of Rockville Townsite Survey, described as follows: Beginning at the southeast corner of said lot 2 in block 3, which point is approximately north six hundred and thirty-nine feet and west nine hundred and twenty-three feet from the southeast corner of section1, township 42 south, range 11 west, and running thence north thirty feet, thence west eighty feet, thence south three hundred and twenty-five feet, thence east eighty feet, thence north two hundred and ninety-five feet to the place of beginning, containing twenty-six thousand square feet, more or less.

An Act to amend the description of the area affected by the Act of May 28, 1928, entitled "An Act for the relief of the town of Springdale, Utah," and for other purposes, approved July 8, 1943 (Public Law 122-78th Congress)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Act of May 28. 1928 (45 Stat. 787, ch. 818), is hereby amended by substituting the following language in lieu of the language in the Act following the words "to grant permission to the town of Springdale, Utah." "to convey through such piping facilities as may he necessary, for domestic and other uses within the limits of said town of Springdale, Utah, water from certain springs in the Zion National Park, Utah, located in sections 17, 22, and 27, township 41 south, range 10 west, Salt Lake base and meridian".

An Act to Include the present area of Zion National Monument within Zion National Park, in the State of Utah, and for other purposes, approved July 11, 1956 (70 Stat. 527) (PL 695) (HR 10535)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of combining Zion National Park and Zion National Monument, Utah, in a single national park unit, in the interest of efficient administration and to preserve adequately the features thereof, Zion National Park hereafter shall comprise the present area of the National Park and the present area of Zion National Monument:

Provided, That the enactment of this Act shall not affect adversely any valid rights or privileges heretofore existing within the areas hereby established as the Zion National Park. (16 USC, § 346b)

Sec. 2. The Secretary of the Interior is authorized to administer Zion National Park as hereby established in accordance with his authority over the park heretofore granted by the Congress and in accordance with the general laws governing areas of the national park system. (16 USC, § 346c)

Sec. 3. All funds heretofore made available for purposes of Zion National Park and Zion National Monument may be used for purposes of Zion National Park as established by this Act. (16 USC, § 346d)

An Act to revise the boundaries of the Zion National Park in the State of Utah, and for other purposes, approved February 20, 1960 (74 Stat. 4) (PL 86-387) (S 713)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the boundaries of the Zion National Park are hereby revised to include the following described lands:

Salt Lake Meridian
T39S, R10 W, sec. 30, those portions of lots 1 to 7, inclusive, lying south of Kolob Creek and lots 8 to 32, inclusive; sec. 31, lots 1, 2, 3, 15, 16, 17, 18, 31, and 32.
T41 S, R10W, sec. 28, NE¼, that portion of the NE¼ lying east of the North Fork of the Virgin River and lot 9 of the O.D. Gifford survey, the ownership of which is recorded on page 247 of deed book U12 in Washington County, Utah; sec. 29, W½; sec. 31; sec. 32 (partly surveyed), NE¼NW¼ and W½NW¼.
T39S, R11W, sec. 13, SE¼SE¼; sec. 32, N½ and SE¼.
T40S, R11W, sec. 5, lots 1 and 2 and S½NE¼.
T38S, R12W, sec. 29, those portions of lot 2 and of the SW¼ lying east of the easterly right-of-way line of the United States Highway 91, identified as project numbered I-01-1 (1), Washington County, Utah, said line being 150 feet from and parallel the centerline of such highway, as constructed. (16 USC, § 346a-1 [Supp. II].))

Sec. 2. Privately owned land, or interests therein, within the aforesaid revised boundary may be acquired by the Secretary of the Interior by purchase, donation, with donated funds, or by such other means as the Secretary may consider to be in the public interest. When acquired, such land and interests in land shall be administered as a part of the Zion National Park in accordance with the provisions of the Act of August 25, 1916 (39 Stat. 535), as amended. (16 USC, § 346a-2 [Supp.II].)

Sec.3. The Secretary of the Interior is authorized to convey to the Utah State Road Commission under such terms and conditions as he may deem necessary such lands or interests in land in lot 3, section 29, T38S, R12W, Salt Lake meridian, containing approximately four and one-half acres, as are required by the Commission for the realignment and construction of United States Highway 91: *Provided*, That, in exchange, the State of Utah constructs an interchange of design, type, and location acceptable to the Secretary which will provide vehicular access between the said highway and Zion National Park. Such conveyed lands shall thereafter be considered as excluded from the Zion National Park and the easterly right-of-way line of United States Highway 91, identified as project numbered I-01-1 (1), Washington County, Utah, shall become the westerly boundary of the Zion National Park in lot 3, section 29, T38S, R12W, Salt Lake meridian. (16 USC, § 346a-3 [Supp.II].)

An Act to provide for increases in appropriation ceilings and boundary changes in certain units of the National Park System, and for other purposes, October 21, 1976 (90 Stat. 2732) (PL 94-578) (HR 13713)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Title III – Miscellaneous Provisions

Zion National Park
Sec. 318. The boundary of Zion National Park is hereby revised to include the area as generally depicted on the map entitled “Land Ownership Types, Zion National Park, Utah”, numbered 116-80, 003, which map shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior. The Secretary of the Interior may acquire the property included by this section by donation only.

Appendix C
5-Year Fuels Treatment Plan
5/27/04

The 5-year plan outlines fuel treatment target areas based on current fuel conditions and national emphasis as of March 2004. Considering the uncertainty of land development, weather (i.e. drought), insect and disease infestations, non-native plant encroachment, and political concerns or new policy directives, this plan is open to modifications and adjustments in the future. Projects not identified in this 5-year plan may need to become a higher priority to address these uncertainties. Therefore the following examples are included as general criteria for selecting future treatment areas that are not currently addressed in the 5-year plan.

- Areas could be selected for treatments that are in condition class 2 and 3 and are within historical fire regimes I, II, and III. An emphasis would be placed on areas along the park boundary next to private property (inholdings) that are within these historical fire regimes and condition classes.
- Areas could be selected where ecological restoration projects would be accomplished to meet cultural or natural resource goals and objectives. Restoration areas may include: wind blow down areas, drought and insect related disturbances, and vegetation type conversions. Some of these areas may fit within the criteria of historical fire regimes and condition classes but this would not be the sole factor for selection of restoration treatments.
- Treatments may be selected where private landowners (inholdings) approach the NPS to do work cooperatively. Treatments may also be selected next to private property and developments that have completed community fire plans.
- Other treatments may be selected, following guidance from the national fire plan, along boundaries with neighboring state or federal agencies that have completed NEPA requirements. This collaborative and cooperative approach may allow treatments to cross boundaries utilizing natural fuel breaks or roads to more efficiently implement fuel treatments.
- Treatments may be implemented in areas that are adjacent to a recent wildland fire, next to previous project areas where a fuels treatment project would enhance public safety, boundary protection, or cultural and natural resource values.
- Treatments may be executed in areas of the park to enhance "Homeland Security" especially in the front country sections of the park from terrorist or arsonist activities.

— 2004 —				
Project Treatment Unit(s) *[Fire Management Zone(s)]*	**Acres**	**Objectives**	**Comments**	**Treatment Schedule**
Clear Trap Prescribed Fire Clear Trap Mountain *[Suppression & Conditional]*	5,500	Hazard fuels reduction: reduce fuel loading and brush density. Ecological benefits: reintroduction of fire and ponderosa pine stand maintenance. Boundary protection/buffer.	Wildland Urban Interface along the east boundary; includes NPS, BLM and private lands (East Zion Focus Area). Final phase of a multi-year project (mechanical cut, and pile burning complete).	Spring/Fall Type 1 burn
Lodge Pile Burning Zion Canyon *[Suppression]*	12	Debris disposal of mechanically treated fuels to reduce fuel loading, brush density, and to create a defensible space around park infrastructures.	Wildland Urban Interface. Mechanical treatment was completed in 2003 (contract).	Winter
Watchman-Pine Creek Housing Pile Burning Watchman-south gate	24	Debris disposal of mechanically treated fuels to reduce fuel loading, brush density, and to create a defensible space around	Wildland Urban Interface. Mechanical treatment was completed in 2003 (contract).	Winter

Appendix C
5-Year Fuels Treatment Plan
5/27/04

— 2004 —				
Project Treatment Unit(s) *[Fire Management Zone(s)]*	**Acres**	**Objectives**	**Comments**	**Treatment Schedule**
[Suppression]		park infrastructures.		
Rockville Bench Pile Burning SW Corner *[Suppression]*	4	Debris disposal of mechanically treated fuels to reduce fuel loading, brush density, and to create a defensible buffer along the park boundary.	Wildland Urban Interface. (mechanical thinning complete).	Winter
Kolob VC Pile Burning Lower Kolob District *[Suppression]*	50	Debris disposal of mechanically treated fuels to reduce fuel loading, brush density; to create a defensible space around park infrastructures and a defensible buffer along the park boundary.	Wildland Urban Interface (I-15 corridor) (mechanical thinning complete).	Winter
East Mesa Boundary Mechanical East Mesa (contract, initiated in 2003) *[Suppression]*	41	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Mechanical thinning (fuel break) along the east boundary (East Zion Focus Area). Future prescribed fire and fire use preparation. Treated fuels will be hand-piled for future burning.	Spring, Summer and /or Fall
Fire Pit Knoll Mechanical KT Road *[Suppression & Modified Suppression]*	3	Hazard fuels reduction: reduce fuel loading and brush density. Structure protection.	Wildland Urban Interface. Mechanical thinning creating a defensible space around structures. Treated fuels will be hand-piled for future burning.	Summer
East Entrance Mechanical East Rim South *[Suppression]*	36	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/buffer.	Wildland Urban Interface (East Entrance Focus Area). Mechanical thinning along the east boundary. Treated fuels will be hand-piled for future burning.	Spring, Summer and/or Fall
Zion Canyon Mechanical Watchman-south gate *[Suppression]*	20	Hazard fuels reduction: reduce fuel loading and brush density. Defensible space around park infrastructures.	Wildland Urban Interface. Mechanical thinning. Treated fuels will be hand-piled for future burning.	Summer
Lava Point Aspen Lava Point (contract) *[Suppression]*	50	Ecological restoration. Hazard fuels reduction: reduce fuel loading and brush density. Defensible space around park infrastructures. Boundary protection/buffer.	Wildland Urban Interface (Kolob Focus Area). Mechanical thinning around the Lava Point ranger cabin and the Lava Point ranger station. Remove shade tolerant species to promote Aspen regeneration. Treated fuels will be transported offsite for biomass utilization.	Fall
Three Finger Mesa Mechanical Horse Pasture/3 Fingers *[Modified Suppression & Suppression]*	12	Fuel reduction along unit boundary in preparation for landscape scale prescribed burn in 2005.	Wildland Urban Interface burn project along the northern boundary. Includes NPS, BLM and private lands (Kolob Focus Area).	Summer
Zion Canyon Mowing Watchman-south gate, Zion Canyon *[Suppression]*	80	Defensible space in and around high visitor use recreation areas.	Create fuel breaks and protect public and staff member from the threat of a wildland fire in fine fuels.	Annual
Exotic (herbicide) 7+ of the treatment units *[Suppression]*	TBD	Ecological maintenance and restoration, to prevent the spread and proliferation of exotic species.	Various spot applications through out the park, targeting exotic grasses, brush, weeds, and trees.	Annual

Appendix C
5-Year Fuels Treatment Plan
5/27/04

— 2005 —				
Project Treatment Unit(s) *[Fire Management Zone(s)]*	**Acres**	**Objectives**	**Comments**	**Treatment Schedule**
Three Finger Mesa Prescribed Fire Horse Pasture/3 Fingers *[Modified Suppression & Suppression]*	2,218	Hazard fuels reduction: reduce fuel loading and brush density. Ecological benefits: reintroduction of fire and stand maintenance. Boundary protection/buffer.	Wildland Urban Interface along the east boundary; includes NPS, BLM and private lands (Kolob Focus Area). Multi-year project.	Spring/Fall Type 1 burn
East Mesa Boundary Pile Burning East Mesa *[Suppression]*	41	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/ defensible space.	Wildland Urban Interface (East Zion Focus Area). Pile burn phase.	Winter
Fire Pit Knoll Pile Burning KT Road *[Suppression & Modified Suppression]*	3	Debris disposal of mechanically treated fuels to reduce fuel loading, brush density, and to create a defensible space around park infrastructures.	Wildland Urban Interface. Pile burn phase.	Winter
East Entrance Pile Burning East Rim South *[Suppression]*	36	Debris disposal of mechanically treated fuels to reduce fuel loading, brush density, and to create a defensible buffer along the park boundary.	Wildland Urban Interface (East Zion Focus Area). Pile burning phase.	Winter
Zion Canyon Pile Burning Watchman-south gate *[Suppression]*	5	Debris disposal of mechanically treated fuels to reduce fuel loading, brush density, and to create a defensible space around park infrastructures.	Wildland Urban Interface. Pile burning phase, if needed.	Winter
Roaring Twenties Mechanical KT Road *[Suppression]*	25	Fuel load reduction, reduce brush density.	Wildland Urban Interface (along KT road corridor/park inholdings). Mechanical bucking and thinning. Treated fuels will be hand-piled or made available for biomass utilization.	Spring, Summer, and/or Fall
Zion Canyon Tamarisk Mechanical Zion Canyon *[Suppression]*	15	Hazard fuels reduction. Defensible space in and around high visitor use recreation areas.	Pile previously mechanically treated tamarisk trees left windrowed along the North Fork of the Virgin River (high risk in a riparian zone).	Spring, Summer, and/or Fall
Zion Lodge Mechanical Zion Lodge *[Suppression]*	45	Hazard fuels reduction: reduce fuel loading and brush density. Defensible space around park infrastructures.	Wildland Urban Interface. Mechanical bucking and thinning. Treated fuels will be hand-piled or made available for biomass utilization.	Spring, Summer, and/or Fall
Cave Valley Mowing KT Road *[Suppression]*	50	Defensible space around the park boundary/inholding, and along the Kolob Terrace Road.	Create fuel breaks and protect public and staff members from the threat of a wildland fire in fine fuels.	Spring and Summer
Zion Canyon Mowing Watchman-south gate, Zion Canyon *[Suppression]*	80	Defensible space in and around high visitor use recreation areas.	Create fuel breaks and protect public and staff members from the threat of a wildland fire in fine fuels.	Biannual
Exotic (herbicide) 7+ of the treatment units *[Suppression]*	TBD	Ecological maintenance and restoration, to prevent the spread and proliferation of exotic species.	Various spot application through out the park, targeting exotic grasses, brush, weeds, and trees.	Annual

Appendix C
5-Year Fuels Treatment Plan
5/27/04

— 2006 —				
Project Treatment Unit(s) *[Fire Management Zone(s)]*	**Acres**	**Objectives**	**Comments**	**Treatment Schedule**
East Mesa Prescribed Fire East Mesa *[Suppression]*	3,000	Hazard fuels reduction: reduce fuel loading and brush density. Ecological benefits: reintroduction of fire and ponderosa pine stand maintenance. Boundary protection/buffer.	Wildland Urban Interface along the east boundary; includes NPS, BLM and private lands (East Zion Focus Area). Final phase of a multi-year project (mechanical cut, and pile burning complete).	Spring/Fall
Roaring Twenties Pile Burning KT Road *[Suppression]*	25	Debris disposal of mechanically treated fuels to reduce fuel loading, brush density, and to create a defensible buffer along the KT road, park boundary, and inholdings.	Wildland Urban Interface. Pile burning phase	Winter
Zion Canyon Tamarisk Pile Burning Zion Canyon *[Suppression]*	15	Debris disposal of mechanically treated fuels to reduce fuel loading.	Pile burning phase.	Winter
Zion Lodge Pile Burning Zion Lodge *[Suppression]*	45	Debris disposal of mechanically treated fuels to reduce fuel loading, brush density, and to create a defensible space around park infrastructures.	Wildland Urban Interface. Pile burning phase.	Spring, Summer, and/or Fall
Lower Lee Valley Mechanical KT Road *[Suppression & Modified Suppression]*	25	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Mechanical thinning (fuel break). Treated fuels will be hand-piled for future burning.	Spring, Summer and /or Fall
Taylor Creek Cabins Mechanical Upper LaVerkin Creek *[Modified Suppression]*	2	Defensible space around historic cabins.	2 cabins	Summer, Fall
Zion Canyon Mowing Watchman-south gate, Zion Canyon *[Suppression]*	80	Defensible space in and around high visitor use recreation areas.	Create fuel breaks and protect public and staff member from the threat of a wildland fire in fine fuels.	Annual
Exotic (herbicide) 7+ of the treatment units *[Suppression]*	TBD	Ecological maintenance and restoration, to prevent the spread and proliferation of exotic species.	Various spot application through out the park, targeting exotic grasses, brush, weeds, and trees.	Annual

Appendix C
5-Year Fuels Treatment Plan
5/27/04

— 2007 —				
Project Treatment Unit(s) *[Fire Management Zone(s)]*	**Acres**	**Objectives**	**Comments**	**Treatment Schedule**
Dakota Hill Prescribed Fire Dakota Hill *[Modified Suppression]*	10,000	Hazard fuels reduction: reduce fuel loading and brush density. Ecological benefits: reintroduction of fire and stand maintenance. Boundary protection.	Landscape sized project, involving BLM, State, and NPS lands. Continuous fuels cross federal managed lands leading to Wildland Urban Interface.	Spring/Fall
Oak Creek Mechanical Watchman-South Gate *[Suppression]*	35	Hazard fuels reduction: reduce fuel loading and brush density. Defensible space around park infrastructures.	Wildland Urban Interface. Mechanical thinning (follow-up treatment). Treated fuels will be hand-piled for future burning.	Summer
Taylor Creek Cabins Pile Burning Upper LaVerkin Creek *[Modified Suppression]*	2	Defensible space around historic cabins.	2 cabins Pile burn phase	Winter
Upper Kolob Creek Mechanical Horse Pasture/3 Fingers (contract) *[Modified Suppression & Suppression]*	100	Ecological restoration. Hazard fuels reduction: reduce fuel loading and brush density. Defensible space around park infrastructures. Boundary protection/buffer.	Wildland Urban Interface. Mechanical thinning near park boundary. Remove shade tolerant species to promote Aspen regeneration. Treated fuels will be transported offsite for biomass utilization.	Summer, Fall
Pine Valley Peak Mechanical (unit preparation) KT Road *[Modified Suppression & Suppression]*	10	Fuel reduction along unit boundary in preparation for landscape scale prescribed burn.	Create defensible boundary along the unit boundary. Includes an expanded version of the previously treated North Gate Peaks and Lee Valley burn units.	Summer, Fall
Camp Creek Mechanical Upper LaVerkin (contract) *[Suppression]*	10	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Mechanical thinning (fuel break) along the boundary.	Spring, Summer and /or Fall
Horse Pasture Mechanical Upper LaVerkin (contract) *[Suppression]*	20	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Mechanical thinning (fuel break) along the boundary.	Spring, Summer and /or Fall
Buck Pasture Mechanical Upper LaVerkin (contract) *[Suppression]*	15	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Mechanical thinning (fuel break) along the boundary.	Spring, Summer and /or Fall
Cave Valley Mowing KT Road *[Suppression]*	50	Defensible space around the park boundary/inholding, and along the Kolob Terrace Road.	Create fuel breaks and protect public and staff members from the threat of a wildland fire in fine fuels.	Biannual
Zion Canyon Mowing Watchman-south gate, Zion Canyon *[Suppression]*	80	Defensible space in and around high visitor use recreation areas.	Create fuel breaks and protect public and staff member from the threat of a wildland fire in fine fuels.	Annual
Exotic (herbicide) 7+ of the treatment units *[Suppression]*	TBD	Ecological maintenance and restoration, to prevent the spread and proliferation of exotic species.	Various spot application through out the park, targeting exotic grasses, brush, weeds, and trees.	Annual

Appendix C
5-Year Fuels Treatment Plan
5/27/04

— 2008 —				
Project Treatment Unit(s) *[Fire Management Zone(s)]*	**Acres**	**Objectives**	**Comments**	**Treatment Schedule**
Pine Valley Peak Prescribed Fire KT Road *[Modified Suppression & Suppression]*	2,000	Hazard fuels reduction: reduce fuel loading and brush density. Ecological benefits: reintroduction of fire and stand maintenance. Boundary protection.	Includes an expanded version of the previously treated North Gate Peaks and Lee Valley burn units.	Spring, Summer, and/or Fall
Watchman Housing Mechanical Watchman – South Gate *[Suppression]*	20	Hazard fuels reduction: reduce fuel loading and brush density. Defensible space around park infrastructures.	Wildland Urban Interface. Mechanical thinning (follow up treatment).	Summer
Upper Wildcat Canyon Mechanical (unit preparation) Horse Pature/3 Fingers *[Modified Suppression & Suppression]*	100	Fuel reduction along unit boundary in preparation for landscape scale prescribed burn in 2005.	Wildland Urban Interface burn project along the northern boundary. May includes NPS and private lands (Kolob Focus Area).	Summer
Herbs Point Mechanical Upper LaVerkin (contract) *[Suppression]*	10	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Mechanical thinning (fuel break) along the boundary.	Spring, Summer and /or Fall
Bullpen Mechanical Upper LaVerkin (contract) *[Suppression]*	10	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Mechanical thinning (fuel break) along the boundary.	Spring, Summer and /or Fall
Zion Canyon Mowing Watchman-south gate, Zion Canyon *[Suppression]*	80	Defensible space in and around high visitor use recreation areas.	Create fuel breaks and protect public and staff member from the threat of a wildland fire in fine fuels.	Annual
Camp Creek Pile & Prescribed burning Upper LaVerkin (contract) *[Suppression]*	363	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Landscape – restoration burn	Spring, /or Fall
Horse Pasture Pile & Prescribed burning Upper LaVerkin (contract) *[Suppression]*	876	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Landscape – restoration burn	Spring, /or Fall
Buck Pasture Pile & Prescribed burning Upper LaVerkin (contract) *[Suppression]*	664	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Landscape – restoration burn	Spring, /or Fall
Exotic (herbicide) 7+ of the treatment units *[Suppression]*	TBD	Ecological maintenance and restoration, to prevent the spread and proliferation of exotic species.	Various spot application through out the park, targeting exotic grasses, brush, weeds, and trees.	Annual

Appendix C
5-Year Fuels Treatment Plan
5/27/04

— 2009 —				
Project Treatment Unit(s) *[Fire Management Zone(s)]*	**Acres**	**Objectives**	**Comments**	**Treatment Schedule**
Upper Wildcat Canyon Prescribed Fire KT Road, Lava Point, Horse Pasture/3 Fingers *[Suppression, Modified Suppression & Conditional]*	8,000	Hazard fuels reduction: reduce fuel loading and brush density. Ecological benefits: reintroduction of fire and stand maintenance. Boundary protection.	Landscape size burn, second entry. Combines Pocket Mesa, Wildcat West, Gap, and blue Springs units.	
Big Bend/Weeping Rock Prescribed Fire Zion Canyon *[Suppression]*	50		Part of the North Fork of the Virgin River Restoration Project (under development).	Spring, Summer, and/or Fall
Upper Kolob Creek Mechanical (unit preparation) Horse Pasture/3 Fingers *[Suppression, Modified Suppression & Conditional]*	1000	Fuel reduction along unit boundary in preparation for landscape scale prescribed burn.	Wildland Urban Interface burn project along the northern boundary. May includes NPS, BLM and private lands. (Kolob Focus Area).	Summer
Jobs Head Mechanical Upper LaVerkin (contract) *[Suppression]*	10	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Mechanical thinning (fuel break) along the boundary.	Spring, Summer, and/or Fall
Pine Spring Wash Mechanical KT Road (contract) *[Suppression]*	10	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Mechanical thinning (fuel break) along the boundary. Treated fuels will be hand-piled for future burn.	Spring, Summer, and/or Fall
Herbs Point Pile & Prescribed burning Upper LaVerkin (contract) *[Suppression]*	288	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Landscape – restoration burn	Spring, /or Fall
Bullpen Pile & Prescribed burning Upper LaVerkin (contract) *[Suppression]*	702	Hazard fuels reduction: reduce fuel loading and brush density. Boundary protection/defensible space.	Wildland Urban Interface. Landscape – restoration burn	Spring, /or Fall
Kolob VC Mechanical Lower Kolob District (contract) *[Suppression]*	50	Hazard fuels reduction: reduce fuel loading and brush density. Defensible space around park infrastructures/boundary protection.	Wildland Urban Interface. Mechanical thinning (follow up treatment).	Summer
Cave Valley Mowing KT Road *[Suppression]*	50	Defensible space around the park boundary/inholding, and along the Kolob Terrace Road.	Create fuel breaks and protect public and staff members from the threat of a wildland fire in fine fuels.	Biannual
Zion Canyon Mowing Watchman-south gate, Zion Canyon *[Suppression]*	80	Defensible space in and around high visitor use recreation areas.	Create fuel breaks and protect public and staff member from the threat of a wildland fire in fine fuels.	Annual
Exotic (herbicide) 7+ of the treatment units *[Suppression]*	TBD	Ecological maintenance and restoration, to prevent the spread and proliferation of exotic species.	Various spot application through out the park, targeting exotic grasses, brush, weeds, and trees.	Annual

Page Intentionally Left Blank

Appendix D
Minimum Impact Suppression Techniques

Minimum impact management is an increased emphasis to do the job of suppressing a wildland fire while maintaining a high standard of caring for the land. Actual fire conditions and good judgment will dictate the actions taken. Firefighter and public safety considerations will be overriding factors for any of the following:

- Fire management activities in the backcountry will minimize degradation in an effort to keep ecosystems unaffected by human influences while protecting and conserving wilderness attributes.
- Careful consideration must be given before using motorized or mechanized equipment. Long-term effects of suppression tactics must be given considerable attention when developing strategies.
- Refer to the most current *Interagency Standards for Fire and Aviation Operations*, Chapter 10, Minimum Impact Suppressions Techniques (MIST).
- All fire management activities will conform to *leave no trace (LNT)* principles and MIST.

The following guidelines would be used when implementing fire management actions in Zion National Park. The Superintendent approves the use of motorized equipment or mechanized transport for:

> Emergencies where the situation involves an inescapable urgency and temporary need for speed beyond that available by primitive means. Categories include fire suppression, health and safety, law enforcement involving serious crime and fugitive pursuit, removal of deceased persons, and aircraft accident investigations.

The recommended and proposed wilderness within Zion National Park will be maintained within the standards of the 1964 Wilderness Act. It is critical that fire suppression actions are undertaken within the spirit of the Wilderness Act, and the need to protect wilderness values relative to suppression actions. This will include use of MIST and may include walking in crews, packing supplies in and out, etc. Within this context, the following fire operations are authorized, as stated, through the Agency Representative in cooperation with the Incident Commander.

Spike Camps within recommended and proposed wilderness – actions that require pre-approval by the Superintendent or concurrence by Resource Chief, Ranger Chief, and Fire Management Officer:
- Location of camp, including maximum number of occupants and estimated duration.
- Location and type of toilet and sanitary facilities.

Aviation Operations within proposed wilderness – actions that require pre-approval by the Superintendent:
- Temporary flight restriction location and extent.

Aviation Operations that <u>do not</u> require pre-approval:
- Long line operations.
- Helicopter water bucket operations.
- Low level reconnaissance flights.
- Use of existing helispots or existing natural openings.

Motorized and mechanical equipment within proposed wilderness – actions that require approval by the Superintendent:
- Heavy equipment, including dozers of any size.
- Any mechanical equipment.

Additional Stipulations:
- The use of retardant and foam around streams and wetlands will use standard protocols of remaining at least 300 feet away.
- Any items not covered above would follow Wilderness ethics guidelines and be approved by the Agency Representative or Superintendent based on delegated authorities.

Page Intentionally Left Blank

Appendix E
US Fish and Wildlife Coordination

3/14

L7617 (ZION-RM&R)

Certified Mail - Return Receipt Requested

March 12, 2003

Henry Maddux, Field Supervisor
United States Department of the Interior
U.S. Fish and Wildlife Service
Utah Field Office
2369 Orton Circle
Salt Lake City, Utah 84115

Dear Mr. Maddux:

Zion National Park is preparing a new environmental assessment (EA) to evaluate potential impacts from fire management projects. This includes non-developed areas of the park and those where urban development either abuts or is in close proximity to park boundaries.

The existing Fire Management Plan was revised in 1992. In this plan, the National Park Service identified management options and zones within the park for the management of naturally ignited lightning fires, prescribed fires, and fire suppression. Our understanding and management of fire has evolved over time recognizing the role of fire in sustaining healthy ecosystems. Under new NPS policies developed from these experiences, additional resources and options are available to implement a fire management program. Priorities within the new policy focus first on the protection of human life. The second priority focuses equally on the protection of resource values and property. This new policy provides direction for park managers to use fire as a tool in maintaining natural process and vegetation community structure.

In order to meet our Section 7 consultation requirements for the EA, we respectfully request that you provide us with the current listings and locations of threatened and endangered species proposed for listing and their associated critical habitats specific to the following Utah counties:

- Washington
- Iron
- Kane.

This letter is the first step of consultation for this EA to ensure that the planning effort adequately addresses Section 7 requirements for the draft Fire EA. As soon as the draft is completed, we will send you a copy with an official transmittal letter for your review and comment.

We look forward to working cooperatively with you on the planning and implementation of this project. If you have any questions or desire more information, please contact Wildlife Biologist Sharon Kim at 435-772-0212.

Sincerely,

Eddie L. Lopez
Acting Superintendent

cc:

Kezia Nielsen, Environmental Protection Specialist, Zion National Park

bcc:

RM Files
Reading
Zion Files

HSKIM:ccr:3/12/03:F:\FWS_FireEA

Appendix E
US Fish and Wildlife Coordination

JEFF BRADSHAW

JEFF - FYI

United States Department of the Interior
FISH AND WILDLIFE SERVICE
UTAH FIELD OFFICE
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UTAH 84119

In Reply Refer To
FWS/R6
ES/UT

April 28, 2003

MAY - 2 2003

Memorandum

To: Acting Superintendent, (Attn: Eddie L. Lopez), National Park Service, Zion National Park, Springdale, Utah 84767

From: Utah Field Supervisor, Fish and Wildlife Service, West Valley City, Utah

Subject: Species List for Washington, Iron, and Kane Counties

Based on information provided in your letter of March 12, 2003, below is a list of endangered (E), threatened (T), and candidate (C) species that may occur in the area of influence of your proposed action.

	Common Name	Scientific Name	Status
IRON			
	Bald Eagle[3]	*Haliaeetus leucocephalus*	T
	California Condor[7]	*Gymnogyps californianus*	E
	Mexican Spotted Owl[1,4]	*Strix occidentalis lucida*	T
	Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	C
	Utah Prairie Dog	*Cynomys parvidens*	T
KANE			
	Jones Cycladenia	*Cycladenia humilis* var. *jonesii*	T
	Kodachrome Bladderpod	*Lesquerella tumulosa*	E
	Navajo Sedge	*Carex specuicola*	T
	Siler Pincushion Cactus	*Pediocactus sileri*	T
	Welsh's Milkweed[4]	*Asclepias welshii*	T
	Kanab Ambersnail[5]	*Oxyloma haydeni kanabensis*	E
	Coral Pink Sand Dunes Tiger Beetle	*Cincindela limbata albissima*	C
	Colorado Pikeminnow[4,10]	*Ptychocheilus lucius*	E
	Razorback Sucker[4,10]	*Xyrauchen texanus*	E
	Bald Eagle[3]	*Haliaeetus leucocephalus*	T
	California Condor[7]	*Gymnogyps californianus*	E
	Mexican Spotted Owl[1,4]	*Strix occidentalis lucida*	T

1

Southwestern Willow Flycatcher[6]	*Empidonax traillii extimus*	E
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	C
Utah Prairie Dog	*Cynomys parvidens*	T
WASHINGTON		
Dwarf Bear-Poppy	*Arctomecon humilis*	E
Holmgren Milkvetch	*Astragalus holmgreniorum*	E
Shivwits Milkvetch	*Astragalus ampullarioides*	E
Siler Pincushion Cactus	*Pediocactus sileri*	T
Virgin River Chub[4]	*Gila seminuda*	E
Woundfin[4]	*Plagopterus argentissimus*	E
Desert Tortoise[4]	*Gopherus agassizii*	T
Bald Eagle[3]	*Haliaeetus leucocephalus*	T
California Condor[7]	*Gymnogyps californianus*	E
Mexican Spotted Owl[1,4]	*Strix occidentalis lucida*	T
Southwestern Willow Flycatcher[1]	*Empidonax traillii extimus*	E
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	C

[1] Nests in this county of Utah.
[3] Wintering populations (only four known nesting pairs in Utah).
[4] Critical habitat designated in this county.
[5] Critical habitat proposed in this county.
[6] Historical range.
[7] Experimental nonessential population.
[10] Water depletions from *any* portion of the occupied drainage basin are considered to adversely affect or adversely modify the critical habitat of the endangered fish species, and must be evaluated with regard to the criteria described in the pertinent fish recovery programs.

The proposed action should be reviewed and a determination made if the action will affect any listed species or their critical habitat. If it is determined by the Federal agency, with the written concurrence of the Service, that the action is not likely to adversely affect listed species or critical habitat, the consultation process is complete, and no further action is necessary.

Formal consultation (50 CFR 402.14) is required if the Federal agency determines that an action is "likely to adversely affect" a listed species or will result in jeopardy or adverse modification of critical habitat (50 CFR 402.02). Federal agencies should also confer with the Service on any action which is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat (50 CFR 402.10). A written request for formal consultation or conference should be submitted to the Service with a completed biological assessment and any other relevant information (50 CFR 402.12).

Candidate species have no legal protection under the Endangered Species Act (ESA). Candidate species are those species for which we have on file sufficient information to support issuance of a proposed rule to list under the ESA. Identification of candidate species can assist environmental planning efforts by providing advance notice of potential listings, allowing resource managers to alleviate threats and, thereby, possibly remove the need to list species as endangered or

threatened. Even if we subsequently list this candidate species, the early notice provided here could result in fewer restrictions on activities by prompting candidate conservation measures to alleviate threats to this species.

Only a Federal agency can enter into formal Endangered Species Act (ESA) section 7 consultation with the Service. A Federal agency may designate a non-Federal representative to conduct informal consultation or prepare a biological assessment by giving written notice to the Service of such a designation. The ultimate responsibility for compliance with ESA section 7, however, remains with the Federal agency.

Your attention is also directed to section 7(d) of the ESA, as amended, which underscores the requirement that the Federal agency or the applicant shall not make any irreversible or irretrievable commitment of resources during the consultation period which, in effect, would deny the formulation or implementation of reasonable and prudent alternatives regarding their actions on any endangered or threatened species.

Please note that the peregrine falcon which occurs in all counties of Utah was removed from the federal list of endangered and threatened species per Final Rule of August 25, 1999 (64 FR 46542). Protection is still provided for this species under authority of the Migratory Bird Treaty Act (16 U.S.C. 703-712) which makes it unlawful to take, kill, or possess migratory birds, their parts, nests, or eggs. When taking of migratory birds is determined by the applicant to be the only alternative, application for federal and state permits must be made through the appropriate authorities. For take of raptors, their nests, or eggs, Migratory Bird Permits must be obtained through the Service's Migratory Bird Permit Office in Denver at (303) 236-8171.

We recommend use of the *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* which were developed in part to provide consistent application of raptor protection measures statewide and provide full compliance with environmental laws regarding raptor protection. Raptor surveys and mitigation measures are provided in the Raptor Guidelines as recommendations to ensure that proposed projects will avoid adverse impacts to raptors, including the peregrine falcon.

The following is a list of species that may occur within the project area and are managed under Conservation Agreements/Strategies. Conservation Agreements are voluntary cooperative plans among resource agencies that identify threats to a species and implement conservation measures to proactively conserve and protect species in decline. Threats that warrant a species listing as a sensitive species by state and federal agencies and as threatened or endangered under the ESA should be significantly reduced or eliminated through implementation of the Conservation Agreement. Project plans should be designed to meet the goals and objectives of these Conservation Agreements.

	Common Name	Scientific Name
IRON		
	Arizona Willow	*Salix arizonica*
	Bonneville Cutthroat Trout	*Oncorhynchus clarki utah*

KANE

Colorado River Cutthroat Trout	*Oncorhynchus clarki pleuriticus*
Coral Pink Sand Dunes Tiger Beetle[1]	*Cicindela limbata albissima*

WASHINGTON

Bonneville Cutthroat Trout	*Oncorhynchus clarki utah*
Virgin Spinedace	*Lepidomeda mollispinis mollispinis*

[1] This is also a candidate species.

If we can be of further assistance or if you have any questions, please feel free to contact Elise Boeke of our office at (801)975-3330 extension 123.

Sincerely,

Henry R. Maddux
Utah Field Supervisor

4

Appendix F
Monitoring Programs

Fire Effects Monitoring Program

Zion National Park is currently utilizing the National Park Service Fire Monitoring Handbook program (National Park Service 2001). Fire effects' monitoring is primarily focused with establishing plots within areas to be treated with prescribed fire. Plot locations are randomly selected and evaluated to determine if the vegetation is representative of the vegetation types being monitored within treatment areas. Depending on the vegetation type, either a grass, brush or forest plot is established (See below for plot layout). The most comprehensive of these plot designs is the forest type for which a 20m x 50m plot is laid out and divided into 4 equal 10m x 25m sections. Re-bar stakes are used to mark the plot origin, corners, and sampling areas. Vegetation sampling is done which may include brush density, herbaceous point intercept, herbaceous density, tree density by size class, and fuel loading. Fuel loading methodology is sampled following Brown's (1974) techniques. (See plot layout focusing on fuel transects below). The plots are photographed and global positioning systems collect location data. Plots are monitored pre-burn, post burn, year 1, 2, 5, and 10 after which time monitoring continues at 10-year intervals. Analysis of fire effects monitoring data shows vegetation trends and responses to prescribed fire treatments. Monitoring allows fire and resource managers to determine whether or not prescribed fire applications are meeting objectives and if necessary, to adjust future treatment prescriptions.

Goals of the Program: Document basic information for all wildland fires, regardless of management strategy, predict fire behavior and take appropriate action on all fires that either: have the potential to threaten resource values or are being managed under specific constraints, such as a prescribed fire, document & analyze both short-term and long-term prescribed fire effects, facilitate the sharing of monitoring data by standardizing data collection and analysis techniques, follow trends in plant communities where fire effects literature exists, or research has been conducted, and identify problem areas where additional research is needed. The following diagrams are examples of plot layouts in the Fire Monitoring Handbook. (National Park Service 2001).

Fire Monitoring Handbook - Plot Layouts

Figure x1. Grass Plot Layout

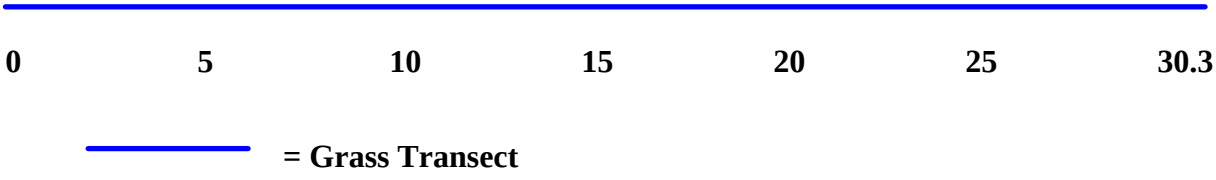


Figure x1 displays the layout for grass transects. Transects are typically set up from 0 to 30.3 meters. Point intercept measurements are taken for 100 points on the transect recording species intercepted, live or dead, and height.

Figure x2. Brush Plot Layout

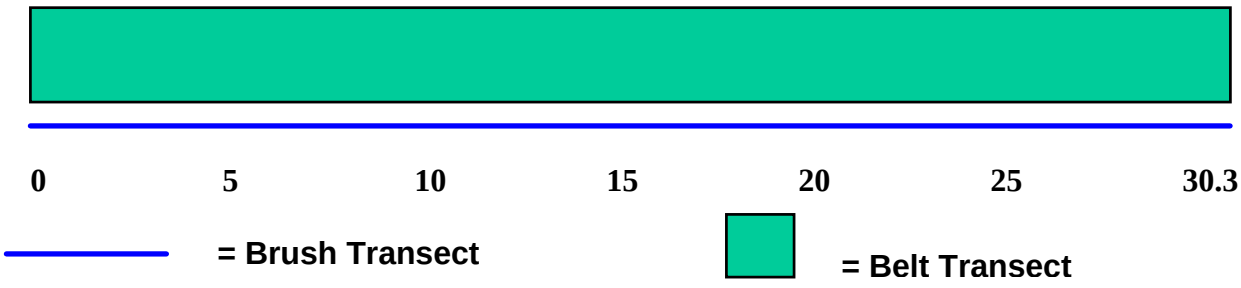


Figure x2 displays the layout for brush transects. Transects are typically set up from 0 to 30.3 meters. Point intercept measurements are taken for 100 points on the transect recording species intercepted, live or dead, and height. A belt is also established where brush density counts occur. These belts vary in width depending on the monitoring objectives. Belt measurements are typically divided into 5 meter intervals and brush species are counted, identified to species, recorded as live or dead, and an age code is recorded. (I = Immature/seedling, R = Resprout, and M = Mature/adult).

Figure x3. Fuel loading transect layout.

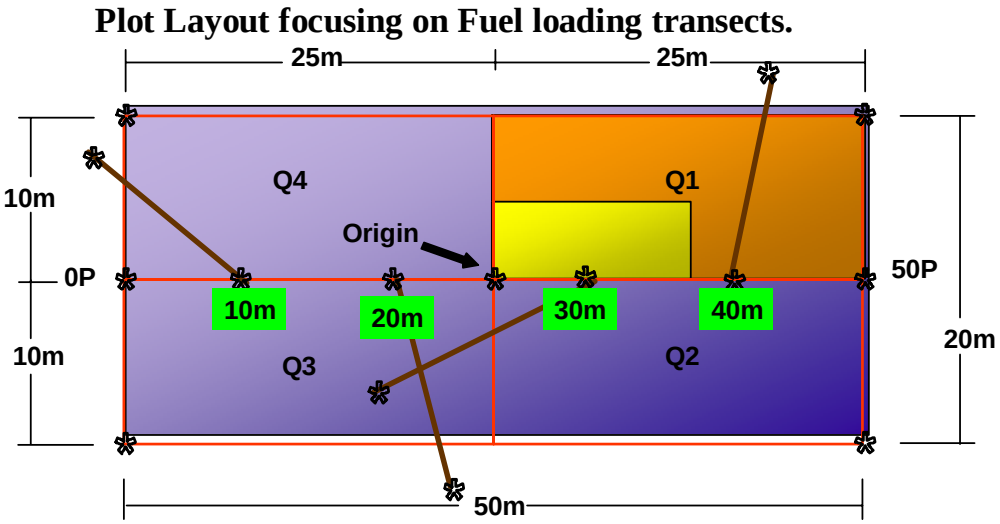


Figure x3 The above figure displays the Browns Fuel Loading transects. Fuel Loading Sampling Transects begin at the 10, 20, 30, 40 meter points along the mid-line of the plot. Dead and down fuels are sampled and categorized along the random transects (as shown above). Fuels that 0-1/4 inch are categorized as 1 hour fuels and are measured from 0 to 6ft. along the transect. Fuels that are ¼ to 1 inch are categorized as 10 hour fuels and are sampled from 0 to 6ft. also. Fuels that are 1 to 3 inches are 100 hour fuels and are sampled 0-12ft. and fuels greater than 3 inches are 1000 hour fuels and are sampled 0 to

Figure x4. Forest Plot Layout

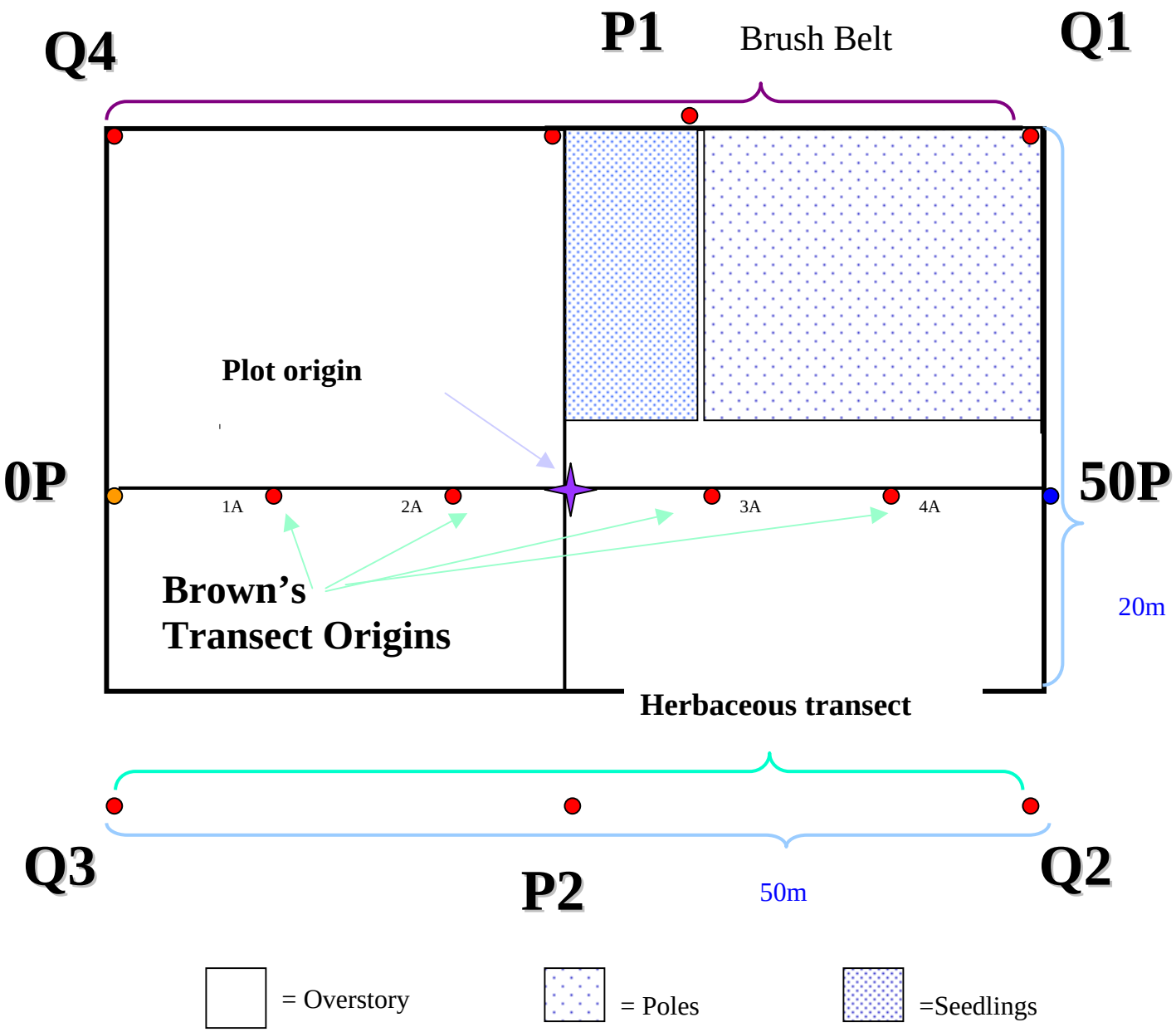


Figure x4 displays the layout for Forest plots. Plots are typically 20 x 50 meters. Fuel loading is done as shown above and in figure x3. Point intercept measurements are taken for at least 100 points up to 166 on the transect recording information described with figure x1. A brush belt is also established along the edge of the plot as described in figure x2. Overstory trees are sampled within the entire macro plot. Pole and seedling trees are sampled in the micro plots as shown in figure x4. Plot photographs are taken at each corner and intersection (Q1-Q4 and 0P-50P) for a total of 8 images.

Appendix F
Monitoring Programs

Mechanical Treatment Monitoring

Mechanically treating fuels has recently become an important part of reducing fuel densities and reducing overall threats associated with wildland fires. Currently the National Park Service does not have a specified set of guidelines or standards for monitoring mechanical treatments. At a minimum the following activities are occurring.

Monitoring Plan: At a minimum "Photo Point Documentation" is being done to document treatments and to demonstrate vegetation changes. Photo points are established prior to treatments. Each photo point is taken from a fixed or permanent location and marked by a rebar with an identification tag. Location information includes the following: a narrative description, a GPS position (UTM) and/or map, a photo log and compass bearing (azimuth) for each image. The GPS/GIS fuels coverage is provided the necessary updates of post-treatment activities for the entire treatment area.

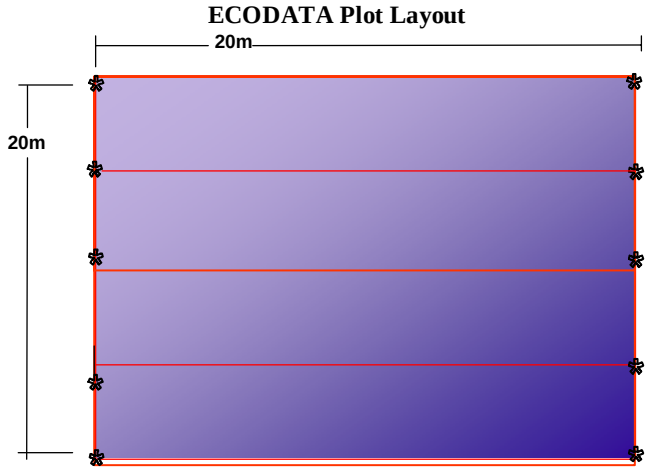
Fuels Treatment Plan: A fuels treatment plan is prepared for each project and includes the following components. This plan includes a description or purpose of the project in an executive summary. A detailed description of the fuels to be treated is discussed. The area is identified with a project map listing the goals and objectives of the project. Project costs are calculated and summarized in the plan. The plan addresses the protection of sensitive features, safety of the personnel and the public, interagency coordination, public involvement, a monitoring plan, and post project rehabilitation issues. The main body of the plan addresses the statement of work to be done and specifications for treatments. These specifications address plant species by diameter and percent of stand for treatment. The monitoring section of the plan contains information on documenting and collecting photo point information and addresses other techniques or methods used to monitor the effectiveness of mechanically treating the vegetation. Monitoring techniques are being evaluated to determine the appropriate strategy to utilize in monitoring these activities.

ECODATA Vegetation Monitoring

Zion National Park instituted this program in 1996 and 1997 with 17 and 16 plots installed respectively. A few plots were monitored in 2001 but in general minimal activity has occurred with this program since it was first established. The methodology is a modified version of the standardized ECODATA protocols used by various agencies in different parts of the country. In general, permanent 1/10 acre plots with 5 sampling transects were established in a variety of vegetation types. Data collected includes; date, observer, plot identification, transect number, plot location, percent cover (all species and ground material), tree data (basal area, dbh, status and trees >7.5"dbh were tagged), and fuel size classes. Some of the data is entered into MS Excel. The data consists of paper data forms, maps, a brief analysis with some tables and graphs, a discussion of procedures, problems, and recommendations for improving the methodology.

Appendix F
Monitoring Programs

Goal of the Program: To collect baseline vegetation data on permanent plots for long-term



monitoring purposes.

Rare Plant Monitoring

Zion National Park had some rare plant work done in conjunction with a threatened and endangered plant project by Stanely Welsh in (1988). From 1998 to the present, rare plant surveys have been done in project areas planned for treatment with prescribed fire. Most of this work consisted of general surveys documenting presence and absence of plants across the project areas. A few areas have had some permanent transects installed to monitor rare plant populations. These transects have utilized the FMH protocols for grass/brush transects with some slight modifications. Data collected includes; date, observer, plot identification, plot location, point-intercept and density of rare plants, percent cover (all species and ground material), tree data (basal area, dbh, status and trees >7.5”dbh were tagged), and fuel size classes. Most of the data is entered into the FMH software, MS word for annual reports, and MS word for rare plant data sheets.

Goal of the Program: To survey areas for rare plant populations documenting their locations and to collect baseline rare plant data on permanent plots for long-term monitoring purposes.

Vegetation Mapping Plots

Beginning In 1999, the vegetation at ZION and surrounding area was mapped through a joint project with the Bureau of Reclamation, The Nature Conservancy (Nature Serve), and the National Park Service. This project was funded through the Inventory and Monitoring and FIREPRO programs to classify and map the vegetation/fuel characteristics of the park. At the present time a few of the original field validation plots have been re-sampled after natural fires have been managed as, “fire use” or fires for resource benefit.

Appendix F
Monitoring Programs

Exotic Plant Monitoring

Exotic plant survey and control actions have been implemented since the early 1990s. The park maintains a database of exotic plant records which contains data about the species, locations, number of plants, eradication dates and methods, size of treated areas, hours for treatments, herbicide name and amount used and personnel involved. The purpose of the program is to maintain records of exotic plant locations and control treatments.

Appendix G
Zion National Park Wildlife List
(Fishes, Amphibians, Reptiles, Mammals)

***Habitat**

D – Desert sagebrush and blackbrush areas, including grassy canyon bottomlands; e.g., Huber Wash, Coalpits Wash, parts of the Chinle Trail, and fields around Springdale.

R – Riparian woodlands along the Virgin River and its tributaries.

P – Pinyon-Juniper woodlands, includes sloping sides of Zion Canyon, often interspersed with scrub oak thickets.

E – Evergreen woodlands including fir, aspen, ponderosa pine, and associated vegetation; plus mountain meadows, side canyons, and canyon walls; e.g., upper portions of the West Rim Trail, Potato Hollow, Hidden Canyon and much of the Kolob Canyons area.

W – On or near water areas, including the Virgin River and tributaries.

C – Caves.

K – Rocky areas.

Common Name	Scientific Name	Habitat*
Fishes		
Brown Trout (exotic)	*Salmo trutta*	R
Cutthroat Trout (exotic)	*Oncorhynchus clarki*	R
Desert Sucker	*Catostomus clarki*	R
Flannelmouth Sucker	*Catostomus latipinnis*	R
Rainbow Trout (exotic)	*Salmo gairdnerii*	R
Speckled Dace	*Rhinichthys osculus*	R
Virgin Spinedace	*Lepidomeda mollispinis*	R
Amphibians		
Arizona Toad	*Bufo microscaphus*	D/P/R
Canyon Treefrog	*Hyla arenicolor*	D/P/R
Great Basin Spadefoot	*Spea intermontana*	D/E/P/R/W
Northern Leopard Frog	*Rana pipiens*	D/P/R/W
Red-spotted Toad	*Bufa punctatus*	D/K/P/W
Tiger Salamander	*Ambystoma tigrinum*	W
Reptiles		
Chuckwalla	*Sauromalus obesus*	D/K
Coachwhip	*Masticophis flagellum*	D/P
Common Kingsnake	*Lampropeltis getula*	D/E/P/R/W
Desert Horned Lizard	*Phrynosoma platyrhinos*	D
Desert Spiny Lizard	*Sceloporus magister*	D/R
Desert Tortoise	*Gopherus agassizii*	D/K
Eastern Fence Lizard	*Sceloporus undulatus*	D/E/P/R
Gila Monster	*Heloderma suspectum*	D/R
Gopher Snake	*Pituophis catenifer*	D/E/R
Great Basin Collared Lizard	*Crotaphytus bicinctores*	D/K/P
Great Basin Rattlesnake	*Crotalus viridis lutosus*	D/E/K/P/R/W
Greater Short Horned Lizard	*Phyrnosoma hernandesi*	D/P
Ground Snake	*Sonora semiannulata*	D/R/P
Longnose Leopard Lizard	*Gambelia wislizenii*	D
Lyre Snake	*Trimorphodon biscutatus*	D/E/P
Mojave Patch-nosed Snake	*Salvadora hexalepis*	D/P
Night Snake	*Hypsiglena torquata*	D/E/P
Plateau Striped Whiptail	*Cnemidophorus velox*	D/P/R
Ringneck Snake	*Diadophis punctatus*	E/R/W
Sagebrush Lizard	*Sceloporus graciousus*	D/P
Side-blotched Lizard	*Uta stansburiana*	D/P
Sonoran Mountain Kingsnake	*Lampropeltis pyromelana*	E/P/R

Appendix G
Zion National Park Wildlife List
(Fishes, Amphibians, Reptiles, Mammals)

Common Name	Scientific Name	Habitat*
Striped Whipsnake	*Masticophis taeniatus*	D/P
Tree Lizard	*Urosaurus ornatus*	D/E/P/R
Utah Banded Gecko	*Coleonyx variegatus utahensis*	D/P
Wandering Garter Snake	*Thamnophis elegans vagrans*	D/P/R/W
Western Skink	*Eumeces skiltonianus*	D/P/R
Western Whiptail	*Cnemidophorus tigris*	D/P
Mammals		
Allen's Big-eared Bat	*Idionycteris phyllotis*	C/E/W
American Badger	*Taxidea taxus*	D
American Beaver	*Castor canadensis*	R/W
American Pika	*Ochotona princeps fuscipes*	E/K
Big Brown Bat	*Eptesicus fuscus*	C/E/W
Big Free-tailed Bat	*Nyctinomops macrotis*	C/D/R/W
Black Bear	*Ursus americanus*	E/R
Black-tailed Jackrabbit	*Lepus californicus*	D
Bobcat	*Lynx rufus*	E/P/R
Botta's Pocket Gopher	*Thomomys bottae*	D/E/P/R
Brazilian Free-tailed Bat	*Tadarida brasiliensis*	C/D
Brush Mouse	*Peromyscus boylii*	D/P/R
Bushy-tailed Woodrat	*Neotoma cinerea*	E
Cactus Mouse	*Peromyscus eremicus*	D/R
California Leaf-nosed Bat	*Macrotus californic*	C
California Myotis	*Myotis californicus*	C/D
Canyon Mouse	*Peromyscus crinitus*	D/P
Chisel-toothed Kangaroo Rat	*Dipodomys microps cel*	D
Cliff Chipmunk	*Tamias dorsalis*	P
Common Gray Fox	*Urocyon cinereoargenteus*	D/P
Common Muskrat	*Ondatra zibethicus*	R/W
Common Porcupine	*Erethizon dorsatum*	E/P/R
Coyote	*Canis latrans*	D/P/R
Deer Mouse	*Peromyscus maniculatus*	D/P/R
Desert Bighorn	*Ovis canadensis*	E/K/P
Desert Cottontail	*Sylvilagus audubonii*	D/P/R
Desert Shrew	*Notiosorex crawfordi*	D
Desert Woodrat	*Neotoma lepida*	D/K/P
Elk	*Cervus elaphus*	E/P
Ermine	*Mustela erminea*	E/P/W
Fringed Myotis	*M. thysanodes*	C/D/E/P/R/W
Golden-mantled Ground Squirrel	*Spermophilus lateralis*	E
Great Basin Pocket Mouse	*Perognathus parvus trumbullensis*	D
Greater Mastiff Bat	*Eumops peroti*	D/K
Hoary Bat	*L. cinereus*	E
House Mouse	*Mus musculus*	D/W
Kit Fox	*Vulpes macrotis*	D
Least Chipmunk	*Tamias minimus*	D/E/P
Little Brown Myotis	*M. lucifugus (Unlikely)*	C/E/P
Little Pocket Mouse	*Perognathus longimembris arizonensi*	D/P
Long-eared Myotis	*M. evotis*	C/E/P
Long-Legged Myotis	*M. volans*	D/E/R/W
Long-tailed Pocket Mouse	*Chaetodipus formosus formosus*	D/P/R
Long-tailed Vole	*Microtus longicaudus*	E/R
Long-tailed Weasel	*Mustela frenata*	E/K/P/W

Appendix G
Zion National Park Wildlife List
(Fishes, Amphibians, Reptiles, Mammals)

Common Name	Scientific Name	Habitat*
Merriam's Kangaroo Rat	*Dipodomys merriami frenatus*	D
Merriam's Shrew	*Sorex merriam*	D
Montane Shrew	*Sorex monticolus*	E
Montane Vole	*Microtus montanus amosus*	E
Mountain Cottontail	*S. nuttallii*	D/E/P
Mountain Lion	*Felis concolor*	E/P/R
Mule Deer	*Odocoileus hemionus*	D/E/P/R
Northern Flying Squirrel	*Glaucomys sabrinus*	E
Northern Grasshopper Mouse	*Onychomys leucogaster*	D
Northern Pocket Gopher	*Thomomys talpoides*	E
Ord's Kangaroo Rat	*Dipodomys ordii cupidineus*	D
Pallid Bat	*Antrozous pallidus*	C/D/W
Pinon Mouse	*Peromyscus truei*	D/P/R
Raccoon	*Procyon lotor*	D/E/P/R/W
Red Fox	*Vulpes vulpes*	D/P/R
Red Squirrel	*Tamiasciurus hudsonicus*	E
Ringtail	*Bassariscus astutus*	K/R
Rock Squirrel	*Spermophilus variegatus*	D/K/P/R
Silver-haired Bat	*Lasionycteris noctivagans*	E/W
Southern Grasshopper Mouse	*Onychomys torridus*	D
Spotted Bat	*Euderma maculatum*	D/W
Striped Skunk	*Mephitis mephitis*	D/E/P/R/W
Townsend's Big-eared Bat	*Corynorhinus townsendii*	C/D/E/P
Uinta Chipmunk	*Tamias umbrinus*	E
Water Shrew	*Sorex palustris*	W
Western Harvest Mouse	*Reithrodontomys megalotis*	D/R
Western Pipistrelle	*Pipistrellus hesperus*	C/D/W
Western Red Bat	*Lasiurus blossevillii*	C/R
Western Small-footed Myotis	*M. ciliolabrum*	C/D/E/R/W
Western Spotted Skunk	*Spilogale gracilis*	K/P/R
White-tailed Antelope Squirrel	*Ammospermophilus leucurus*	D
White-tailed Jackrabbit	*Lepus townsendii*	E
Yellow-bellied Marmot	*Marmota flaviventris*	E/K
Yuma Myotis	*M. yumanensis*	C/D

Page Intentionally Left Blank

Appendix H
Zion National Park Bird List

The following bird list is arranged alphabetically by habitat type and within the habitat type, alphabetically by common name.

Habitats

A birds may be seen in almost any habitat type.

D desert sagebrush and blackbrush areas, including grassy canyon bottomlands; e.g. Huber Wash, Coalpits Wash, parts of Chinle Trail.

E evergreen woodlands—including fir, aspen, ponderosa pine, and associated vegetation—plus mountain meadows, side canyons, and canyon walls; e.g. upper parts of the West Rim Trail, Potato Hollow, Hidden Canyon, and much of the Kolob Canyons area.

P pinyon-juniper woodlands, including the sloping sides of Zion Canyon, possibly with interspersed scrub oak thickets.

R riparian woodlands along the Virgin River and its tributaries.

W on or near water areas, including the Virgin River and tributaries, Kolob and Blue Springs Reservoirs, and Springdale Ponds.

Abundance

c common - seen most days in correct season and habitat.

u uncommon - seen in low numbers in correct season and habitat.

r rare - no more than a few sightings per year.

s sporadic - may be numerous in some years and entirely absent in other years.

x accidental - seen no more than a few times or reported but not well documented.

- species not known to occur in this season or data not available.

*** breeds in Zion**
******recently introduced to northern Arizona

Common Name	Spring	Summer	Fall	Winter	Habitat
Any Habitat Park-wide					
American Robin*	c	c	c	c	A
Black-chinned Hummingbird*	c	c	c	-	A
Brown-headed Cowbird*	c	c	r	-	A
Common Nighthawk	u	u	u	-	A
Common Raven*	c	c	c	c	A
Dark-eyed Junco*	c	c	c	c	A
Great Horned Owl*	u	u	u	u	A
Lesser Goldfinch*	c	c	c	u	A
Mourning Dove*	c	c	r	r	A
Peregrine Falcon*	u	u	u	u	A
Red-tailed Hawk*	c	c	c	c	A
Turkey Vulture*	u	c	u	x	A
Violet-green Swallow*	c	c	c	-	A
White-crowned Sparrow	c	r	c	c	A
White-throated Swift*	c	c	c	r	A
Desert Sagebrush-Blackbrush					
American Pipit	u	-	u	u	D
Black-throated Sparrow*	c	c	r	x	D
Chestnut-collared Longspur	-	-	x	-	D
Costa's Hummingbird*	u	r	-	-	D
Greater Roadrunner	u	u	u	u	D
Horned Lark	r	-	r	u	D

Appendix H
Zion National Park Bird List

Common Name	Spring	Summer	Fall	Winter	Habitat
Lesser Nighthawk	-	r	-	-	D
Mountain Plover	x	-	-	-	D
Northern Harrier	u	r	u	u	D
Northern Shrike	-	-	-	r	D
Ring-necked Pheasant*	r	r	r	r	D
Rough-legged Hawk	u	-	u	u	D
Sage Thrasher	r	-	x	-	D
Savannah Sparrow	u	x	r	r	D
Verdin	-	-	x	x	D
Western Meadowlark*	u	u	u	r	D
Desert Sagebrush-Blackbrush/Evergreen Woodlands					
Brewer's Sparrow	c	u	c	r	D/E
Cassin's Finch*	u	u	u	s	D/E
Loggerhead Shrike	r	-	r	r	D/E
Mountain Bluebird*	u	u	u	u	D/E
Prairie Falcon	r	r	r	r	D/E
Swainson's Hawk	r	r	r	-	D/E
Vesper Sparrow*	c	u	c	x	D/E
Desert Sagebrush-Blackbrush/Evergreen Woodlands/Pinyon-Juniper Woodlands					
Bushtit*	c	c	c	c	D/E/P
Chipping Sparrow*	c	c	c	r	D/E/P
Common Poorwill*	u	u	u	-	D/E/P
Golden Eagle*	u	u	u	u	D/E/P
Desert Sagebrush-Blackbrush/Evergreen Woodlands/Riparian Woodlands					
American Kestrel*	c	c	c	c	D/E/R
Green-tailed Towhee*	u	u	u	x	D/E/R
Lincoln's Sparrow*	u	r	u	u	D/E/R
MacGillivray's Warbler	u	u	r	-	D/E/R
Western Bluebird*	c	u	c	u	D/E/R
Desert Sagebrush-Blackbrush/Pinyon-Juniper Woodlands					
American Tree Sparrow	x	-	x	-	D/P
Bewick's Wren*	c	c	c	c	D/P
Black-billed Magpie	x	-	-	x	D/P
Black-chinned Sparrow*	r	r	r	-	D/P
Blue-gray Gnatcatcher*	c	c	r	r	D/P
Ferruginous Hawk	r	r	r	r	D/P
Gray-crowned Rosy-Finch	-	-	-	s	D/P
Long-eared Owl	x	-	-	-	D/P
Northern Mockingbird*	r	u	-	r	D/P
Rock Wren*	c	c	c		D/P
Rufous-crowned Sparrow*	r	r	r	r	D/P
Sage Sparrow	r	x	x	r	D/P
Scott's Oriole	r	r	r	-	D/P
Desert Sagebrush-Blackbrush/Pinyon-Juniper Woodlands/Riparian Woodlands					
House Finch*	c	c	c	c	D/P/R
Phainopepla*	r	u	u	-	D/P/R
Desert Sagebrush-Blackbrush/Riparian Woodlands					
American Goldfinch	u	-	u	u	D/R
Anna's Hummingbird	x	x	-	-	D/R
Crissal Thrasher	x	-	x	-	D/R
European Starling*	c	c	c	c	D/R
Fox Sparrow	x	-	x	r	D/R

Appendix H
Zion National Park Bird List

Common Name	Spring	Summer	Fall	Winter	Habitat
Gambel's Quail*	u	u	u	u	D/R
Golden-crowned Sparrow	r	-	r	r	D/R
Great-tailed Grackle	r	r	-	-	D/R
Harris' Sparrow	-	-	-	x	D/R
House Sparrow*	c	c	c	c	D/R
Ladder-backed Woodpecker	r	r	r	r	D/R
Lark Sparrow*	u	u	u	x	D/R
Rock Dove	r	r	r	r	D/R
Say's Phoebe*	c	c	c	u	D/R
Western Kingbird*	c	c	u	-	D/R
White-throated Sparrow	r	-	r	r	D/R
Desert Sagebrush-Blackbrush/On or Near Water					
Barn Swallow	r	-	r	-	D/W
Cliff Swallow*	u	u	u	-	D/W
Killdeer*	u	u	u	u	D/W
Evergreen Woodlands					
Acorn Woodpecker	x	r	-	-	E
Band-tailed Pigeon*	x	u	x	-	E
Blue Grouse*	u	u	u	u	E
Broad-tailed Hummingbird*	u	u	u	-	E
Clark's Nutcracker	r	-	r	r	E
Grace's Warbler*	c	c	r	-	E
Hooded Warbler	-	-	x	-	E
Lewis' Woodpecker	x	-	r	r	E
Northern Goshawk*	r	r	r	r	E
Olive-sided Flycatcher*	u	u	u	-	E
Pine Grosbeak	x	-	-	x	E
Pygmy Nuthatch*	u	u	u	u	E
Red Crossbill*	s	s	s	s	E
Red-breasted Nuthatch*	r	u	r	r	E
Spotted Owl*	u	u	u	u	E
Swainson's Thrush	r	-	x	-	E
Townsend's Warbler	-	-	x	-	E
Evergreen Woodlands/Pinyon-Juniper Woodlands					
California Condor**	x	x	x	x	E/P
Canyon Wren*	c	c	c	c	E/P
Flammulated Owl*	r	r	r	-	E/P
Golden-crowned Kinglet	r	-	-	u	E/P
Ruby-crowned Kinglet	c	r	c	c	E/P
Townsend's Solitaire*	c	u	c	u	E/P
White-breasted Nuthatch	u	u	u	u	E/P
Williamson's Sapsucker	-	-	r	r	E/P
Zone-tailed Hawk	-	x	x	-	E/P
Evergreen Woodlands/Pinyon-Juniper Woodlands/Riparian Woodlands					
Ash-throated Flycatcher*	u	c	-	-	E/P/R
Black-capped Chickadee*	c	c	c	c	E/P/R
Black-headed Grosbeak*	c	c	r	-	E/P/R
Brown Creeper*	u	r	u	u	E/P/R
Cooper's Hawk*	c	c	c	c	E/P/R
Downy Woodpecker*	u	u	u	u	E/P/R
Dusky Flycatcher*	u	u	u	c	E/P/R
Hairy Woodpecker*	c	c	c	c	E/P/R

Appendix H
Zion National Park Bird List

Common Name	Spring	Summer	Fall	Winter	Habitat
Mountain Chickadee*	c	c	c	c	E/P/R
Northern Flicker*	u	u	u	c	E/P/R
Northern Pygmy-Owl*	u	u	u	u	E/P/R
Pine Siskin*	u	r	u	u	E/P/R
Red-naped Sapsucker*	c	u	c	s	E/P/R
Sharp-shinned Hawk*	u	u	u	u	E/P/R
Spotted Towhee*	c	c	c	c	E/P/R
Steller's Jay*	c	c	c	c	E/P/R
Virginia's Warbler*	c	c	u	-	E/P/R
Evergreen Woodlands/Riparian Woodlands					
Brewer's Blackbird*	u	u	u	r	E/R
Calliope Hummingbird	r	-	r	-	E/R
Cordilleran Flycatcher*	u	u	-	-	E/R
Evening Grosbeak	s	s	s	s	E/R
Hammond's Flycatcher	r	-	r	-	E/R
Hermit Thrush*	u	c	u	u	E/R
Northern Saw-whet Owl	s	s	s	s	E/R
Orange-crowned Warbler*	u	u	u	x	E/R
Plumbeous Vireo*	c	c	c	-	E/R
Rufous Hummingbird	-	r	u	-	E/R
Warbling Vireo*	c	c	c	-	E/R
Western Screech-Owl*	u	u	u	u	E/R
Western Tanager*	c	c	c	-	E/R
Western Wood-Pewee*	u	c	u	-	E/R
Wild Turkey*	c	c	c	c	E/R
Yellow-rumped Warbler*	c	u	c	u	E/R
Evergreen Woodlands/On or Near Water					
Tree Swallow*	c	c	r	-	E/W
Pinyon-Juniper Woodlands					
Black-throated Gray Warbler*	c	c	u	-	P
Gray Flycatcher*	u	u	-	-	P
Gray Jay	-	-	-	x	P
Gray Vireo*	u	u	-	-	P
Juniper Titmouse*	c	c	c	c	P
Pinyon Jay*	u	u	u	u	P
Short-eared Owl	-	x	-	-	P
Snow Bunting	-	-	-	x	P
Three-toed Woodpecker	-	-	-	x	P
Pinyon-Juniper Woodlands/Riparian Woodlands					
American Crow	r	r	r	r	P/R
Barn Owl	r	r	r	r	P/R
Cassin's Kingbird*	u	u	r	-	P/R
Eastern Kingbird	x	-	x	-	P/R
Lazuli Bunting*	c	c	c	-	P/R
Merlin	-	-	r	r	P/R
Painted Redstart	r	-	-	-	P/R
Western Scrub-Jay*	c	c	c	c	P/R
Riparian Woodlands					
Abert's Towhee	-	-	r	r	R
American Redstart	x	x	x	-	R
Bell's Vireo*	-	r	-	-	R
Black Phoebe*	u	u	u	u	R

Appendix H
Zion National Park Bird List

Common Name	Spring	Summer	Fall	Winter	Habitat
Black Swift	r	-	r	-	R
Black-and-white Warbler	x	x	-	-	R
Blue Grosbeak*	u	u	u	-	R
Blue-throated Hummingbird	-	x	-	-	R
Bohemian Waxwing	-	-	-	s	R
Broad-billed Hummingbird	-	-	x	-	R
Broad-winged Hawk	x	-	-	-	R
Brown Thrasher	x	-	-	x	R
Bullock's Oriole*	c	c	r	-	R
Cedar Waxwing	u	-	u	u	R
Common Black-Hawk	r	r	-	-	R
Common Yellowthroat*	u	r	-	-	R
Eastern Phoebe	x	-	x	-	R
Gray Catbird	-	-	x	x	R
Hermit Warbler	-	x	-	-	R
Hooded Oriole	r	r	-	-	R
House Wren*	c	c	r	r	R
Inca Dove	x	x	x	x	R
Indigo Bunting*	r	r	-	-	R
Lucy's Warbler*	c	c	-	-	R
Magnificent Hummingbird	x	x	-	-	R
Nashville Warbler	r	-	r	-	R
Northern Waterthrush	r	-	x	-	R
Ovenbird	x	-	-	-	R
Red-shouldered Hawk	-	x	-	x	R
Rose-breasted Grosbeak	r	r	-	-	R
Summer Tanager*	u	u	r	-	R
Swamp Sparrow	x	-	-	-	R
Varied Thrush	x	-	-	-	R
Vaux's Swift	x	-	x	-	R
Vermilion Flycatcher	x	x	-	-	R
Whip-poor-will	r	-	-	-	R
White-winged Dove	x	-	-	-	R
Willow Flycatcher*	r	r	-	-	R
Wilson's Warbler	u	-	r	x	R
Winter Wren*	r	r	r	u	R
Yellow Warbler*	c	c	c	-	R
Yellow-billed Cuckoo	-	r	r	-	R
Yellow-breasted Chat*	u	r	x	-	R
Riparian Woodlands/On or Near Water					
Bank Swallow	r	-	-	-	R/W
Belted Kingfisher*	u	u	u	u	R/W
Common Snipe	u	x	u	u	R/W
Marsh Wren*	u	-	u	u	R/W
N. Rough-winged Swallow*	c	u	r	-	R/W
Red-winged Blackbird*	u	u	u	r	R/W
Song Sparrow*	c	c	c	c	R/W
Yellow-headed Blackbird	r	-	r	-	R/W
On or Near Water					
American Avocet	u	-	r	-	W
American Bittern	x	-	x	-	W
American Coot*	u	r	u	c	W

Appendix H
Zion National Park Bird List

Common Name	Spring	Summer	Fall	Winter	Habitat
American Dipper*	c	c	c	c	W
American White Pelican	x	-	r	-	W
American Wigeon	u	-	u	u	W
Baird's Sandpiper	x	-	x	-	W
Bald Eagle	r	r	r	u	W
Black Tern	-	x	-	-	W
Black-bellied Plover	-	-	-	x	W
Black-crowned Night Heron	r	r	r	r	W
Black-necked Stilt	u	-	x	-	W
Blue-winged Teal	u	r	r	r	W
Bonaparte's Gull	x	-	x	-	W
Bufflehead	u	-	u	u	W
California Gull	u	-	r	-	W
Canada Goose	r	-	r	u	W
Canvasback	u	-	u	u	W
Caspian Tern	x	-	x	-	W
Cattle Egret	r	-	r	-	W
Cinnamon Teal*	c	u	c	u	W
Clark's Grebe	x	-	-	-	W
Common Goldeneye	u	-	u	u	W
Common Loon	r	-	r	-	W
Common Merganser*	u	r	u	u	W
Double-crested Cormorant	r	x	-	-	W
Eared Grebe	c	-	c	u	W
Forster's Tern	r	x	x	-	W
Franklin's Gull	r	-	-	-	W
Gadwall	u	-	u	u	W
Great Blue Heron	u	r	u	u	W
Great Egret	r	-	x	-	W
Greater Yellowlegs	u	-	x	-	W
Green Heron	r	-	r	-	W
Green-winged Teal*	c	r	c	u	W
Herring Gull	x	-	x	x	W
Hooded Merganser	r	-	r	r	W
Horned Grebe	x	-	r	r	W
Least Sandpiper	u	-	u	-	W
Lesser Scaup	u	-	u	u	W
Lesser Yellowlegs	r	-	x	-	W
Long-billed Curlew	x	-	-	-	W
Long-billed Dowitcher	u	-	x	-	W
Mallard*	c	c	c	c	W
Marbled Godwit	r	-	-	-	W
Northern Pintail*	u	-	u	u	W
Northern Shoveler	u	-	u	u	W
Oldsquaw	-	-	-	x	W
Osprey	r	-	r	x	W
Pectoral Sandpiper	x	-	x	-	W
Pied-billed Grebe	u	r	u	u	W
Red Phalarope	x	-	-	-	W
Red-breasted Merganser	u	r	u	r	W
Redhead	u	-	u	r	W
Red-necked Phalarope	r	-	r	-	W

Appendix H
Zion National Park Bird List

Common Name	Spring	Summer	Fall	Winter	Habitat
Ring-billed Gull	u	-	r	r	W
Ring-necked Duck	c	-	c	u	W
Ruddy Duck	u	-	u	u	W
Rusty Blackbird	-	x	-	-	W
Sanderling	x	-	-	-	W
Sandhill Crane	-	-	-	x	W
Semipalmated Plover	r	-	r	-	W
Snow Goose	r	-	r	-	W
Snowy Egret	u	-	r	-	W
Snowy Plover	-	x	-	x	W
Solitary Sandpiper	r	-	r	-	W
Sora*	r	r	r	r	W
Spotted Sandpiper*	u	u	u	r	W
Surf Scoter	-	-	-	x	W
Tundra Swan	-	-	-	x	W
Virginia Rail*	r	r	r	r	W
Wandering Tattler	-	-	x	-	W
Western Grebe	r	-	r	-	W
Western Sandpiper	u	-	u	-	W
White-faced Ibis	u	-	r	-	W
White-winged Scoter	-	-	x	-	W
Willet	u	-	-	-	W
Wilson's Phalarope	u	-	r	-	W
Wood Duck	u	-	u	u	W
Wood Stork	-	x	-	-	W