Klamath Falls Resource Area Environmental Assessment #OR014-94-09

Need for the Proposed Action

Introduction

The relationship of earth and fire are inseparable and go back to the beginning of time. The vegetation upon the planet has evolved, survived and in many cases owes its existence to the periodic occurrence of fire. Recorded history has demonstrated that humankind has used fire to shape the natural surroundings and also retard fire by attempting short term periods of complete fire suppression. Fire will periodically occur despite previous short term fire suppression, under extremely dry, windy or unstable atmospheric conditions. Such burning conditions are outside the parameters of human control and result in "Blowup Fires" or "Conflagrations". The unnatural fuelbed that accumulated during suppression results in a wildfire which has undesirable severe plant, animal, and physical effects. The type of fire is the same whether the ignition source is volcanic activity, lightning, or "anthropogenic" (man caused) ignition.

Historical Background

To understand the amount of vegetation change that has occurred in the area over the last 100 years, consider past observations. Many diaries, articles and historical documents paint a landscape that in many situations is quite different from the landscape of today.

The forests and grasslands of South Central Oregon are particularly dependent on frequent surface fires, with historical fires occurring on 8 to 12 year intervals in the lower elevation Ponderosa Pine Communities. Early Native American and nineteenth century settlement burning shortened this frequency to 2 to 5 years. Vast areas of grassland burned frequently whenever early season rainfall produced bumper crops of surface vegetation. Range Fires are known to have historically controlled the spread of juniper trees throughout South Central Oregon. Even the high elevation true fir associations were shaped by fire which occurred at approximately 40 year intervals. Only infrequently did anthropogenic burning occur at higher elevations. The xeric climate of South Central Oregon retarded the biotic breakdown of dead material that accumulated on the forest floor, creating a continuous cured and flammable fuel bed. Thunder storms ignited the fuels which then burned under a variety of weather conditions.

The size of historic fires varied depending on vegetation type, elevation and slope. On level terrain fires were generally small but numerous. Large fires occurred when climate or weather conditions were favorable. Larger fires were more typical at higher elevations and on steeper slopes.

The vegetation on the forest floor was historically made up of forbs and grasses with pine needle and duff layers of less than ½ inch (typical fuel weight would be <14 tons/acre, including down logs). Historic accounts state that large woody material was essentially absent, being consumed by frequent surface fires. Snags were also subjected to the effects of fire, falling to serve as down logs (typically 50' lineal feet of greater than 12" material per acre at lower elevations). At upper elevations, where fire intervals were longer, fire events killed larger numbers of trees which resulted in larger amounts of down woody material. Live trees were recruited by fire and insects to serve as replacement snags. Many green trees had dead "spike tops". In spite of this, the "pristine" or "primeval" forest so noted in writings of the past survived and prospered. Further reading on the historical role of fire in the vegetation communities can be found in the "List of References and Suggested Reading" section at the end of this document.

Current Situation

The absence of fire and activities associated with European settlement have created fuel loads in the Resource Area in excess of any known occurrence in history (these fuels range from 20 to 100 tons/acre). When wildfire does occur, the results are not advantageous to any resource. The question is not if fire will occur, but when and how it will occur. Episodic events which occurred under the worst weather conditions in the previous decade have provided many examples of this phenomenon. Historical accounts within our own century point to cyclic patterns of drought which increase the scope and intensity of wildfire.

The ever growing Rural/Urban Interface Areas (RIA) within the Resource Area place the human inhabitants who live in these areas at ever-increasing risk regardless of the alternative. The development of adequate defensible space surrounding rural dwellings and using fire resistant building materials in construction is imperative if those dwellings are to survive an occurrence of wildfire.

Recent wildfires are examples of what will occur under the no action alternative. The fuel on the forest floor deepens and needles become draped on shrubs. Shrubs become decadent, containing much dead wood. The volume of windfalls increases and is accelerated by human activities, such as some types of logging and other silvicultural practices (i.e. pre-commercial thinning). Tree reproduction increases, often with species that are not fire resistant. Increased shade and wind resistance inhibit drying of fine dead fuels. The tree thickets themselves become fuel. Overstocked stands are more susceptible to the effects of drought and then insect attack. Mortality increases in the overstory because of an overstocked understory. Dead trees become aerial fuels which eventually fall and become surface fuels. Fire behavior changes while intensity increases. Fires can spread readily only during longer dry periods. Fires under these conditions are likely to kill the entire timber stand, have a more severe effect on the site, and lead to even aged forests (i.e. plantations). Stand replacing wildfires occasionally occurred in the absence of fire suppression but they were atypical for South Central Oregon.

In this geographical area, it is apparent that the "natural", low intensity fires of the past that were successfully extinguished by protection agencies often were the fires which should have been allowed to burn within confined landscapes. Many past decisions were made without clear knowledge of fire effects and it's ecological role. No reasonable decision could be made without understanding the fact that different plant associations throughout the United States have different types of Fire Regimes. Historical accounts of fires in the Great Lake states and Northern Idaho, or cultural bias have shaped the public's attitude against fire. Human activities prior to these events contributed to their intensity and severity. Events in history have molded public conception of the "ravages" of fire. This often has resulted in political decisions that caused the fire problem to worsen. It is ironic that many political decisions of the last 100 years will result in reoccurrence of catastrophic fire events.

A description of the affected environment is located in the Draft Resource Management Plan (RMP) for the Klamath Falls Resource Area.

USFS Plant Associations are used in this EA for the purpose of describing vegetation within the project area where the adjacent National Forest Lands have been classified. It is reasonable, with some confidence, to classify like vegetation on adjacent BLM-administered lands.

Areas that most closely resemble USFS Plant Association exist within the Gerber Reservoir, Yainax Butte, Bly Mountain, Swan Lake and Surveyor Mountain areas. The areas south of Highway 66 are likely to have additional areas that are not represented by the listed Plant Associations. Interim plant communities are assigned in these areas. The Plant Associations are listed in Table 1.

R6-Ecol-79-004 Fremont National Forest

* Low Sagebrush - Goldenweed/Bluegrass	SD-92-11
Bluegrass - Dry Meadow	MD-31-11
Hairgrass - Sedge - Moist Meadow	MM-19-11
Sedge - Wet Meadow	MW-19-11
[1] Low Sagebrush/Fescue - Squireltail	SD-92-13
*[1] Juniper/Low Sagebrush/Fescue	CJ-S1-12
Alpine Low Sagebrush/Red Fescue	SS-49-21
Lodgepole Pine - Whitebark Pine/Gay Penstemon	CL-C1-11
* Ponderosa Pine - Juniper/Mtn. Mahogany - Bitterbrush/Fescue (Pine Savannah)	CP-C2-11
* Ponderosa Pine/Wooly Wyethia (Lower Pine)	CP-F1-11
* White Fir - Ponderosa Pine/Snowberry/Starwort (High Pine)	CW-S3-13
White Fir - Ponderosa Pine -Incense Cedar/ Service Berry	CW-C1-11

R6-Ecol-79-005 South Winema National Forest

Low Sagebrush/Fescue - Squireltail	SD-19-13
White Fir - Alder/Shrub Meadow	CW-M1-11
* Mixed Conifer/Snowbrush - Bearberry (West Mixed Conifer)	CW-C2-15
* Mixed Conifer/Snowbrush - Squaw Carpet/Strawberry (East Mixed Conifer)	CW-S1-16
White Fir/Snowberry/Strawberry	CW-S3-12
White Fir/Chinquapin - Boxwood - Prince's Pine/ Long-Stolen Sedge	CR-S3-11
* Shasta Red Fir - White Fir/Chinquapin - Boxwood - Prince's Pine/Long-Stolen Sedge	CR-S3-11
[2] Shasta Red Fir/Long Stolen Sedge	CR-G1-11
Shasta Red Fir - Mtn. Hemlock/Pinemat Manzanita/ Long-Stolen Sedge	CR-S1-12

Draft Rogue River/Siskiyou Association Guide

[3] White Fir - Douglas Fir/Piper's Oregon Grape	ABCO-PSME/BEPI
White Fir - Shasta Red Fir/Common Prince's Pine	ABCO-ABMAS/CHUM
White Fir - Incense Cedar/Dwarf Oregon Grape	ABCD-CADE3/BENE

Interim Plant Communities South of Highway 66 in western Klamath County

[3] Douglas Fir - Ponderosa Pine/Manzanita - Oregon Grape	PSME-PIPO/RRPA-BEAQ
White Fir - Douglas Fir/Greenleaf Manzanita	ABCO-PSME/ARPA
[4] Ponderosa Pine - Jeffery Pine - Oregon White Oak/ Wedgeleaf Ceanothus	PIPO-PIJE - QUGA/CECU

[1] Included into SD-92-11 for effects
[2] Included into CR-S3-11 for effects
[3] Included into CW-C2-15 for effects

Alternatives including the Proposed Action

Scope and Objectives

The scope of this action includes all future fire management operations for public lands administered by the BLM within the entire Klamath Falls Resource Area. The proposed action is in conformance with the current Lost River and Klamath Management Framework Plans, the Draft Klamath Falls RMP and Environmental Impact Statement (EIS) which includes the actions described within this EA, and prescribed burning as described in the Vegetation Treatment EIS (Thirteen Western States), and the Final Supplemental EIS on Management of Forests Within the Range of the Spotted Owl (FSEIS).

There are four objectives:

* Reintroduce fire into areas in which fire has had a profound biological influence on ecosystem composition, structure, and function. Fire has played a major role in the early development and maintenance of plant associations in South Central Oregon.

* Restore sustainable function and structure to plant communities, which would improve forest health in fire-adapted ecosystems. This would include restoring forest (and other plant communities) composition from fire-intolerant species to fire-resistant species. The populations of encroaching White Fir and Western Juniper would be reduced.

* Reduce major losses of sustainable ecosystem resources from catastrophic wildfire, which results from heavy fuel loadings and vegetation changes that developed with "pseudo successful" total fire suppression. Reduce the potential for severe high-damage, forest overstory/stand replacing fires.

* Reduce overall fire management costs by reducing the number of large acreage multi-burn period (large fires burning over many days) fires. Reduce the number and type of suppression resources needed in extended attack and project fire situations. The number and types of Initial Attack (IA) resources would remain unchanged. The BLM fire planning process would recognize the changes in the amount of burned area, fire intensity and adjust IA resources.

Actions Common to All Alternatives

Wildfire suppression would still occur where Prescribed fires are not planned and authorized. An Escaped Fire Situation Analysis would be prepared for each fire that is active and unconfined into a second burning period.

The Lakeview District Fire Management Activity Plan (FMAP) would continue to be implemented under all alternatives. This activity plan describes the process for suppression of unplanned and unauthorized fires.

All alternatives would require attempting confinement of the fire to a specific area. However, the alternatives vary considerably with regard to the success and impacts of confinement. Firelines constructed prior to the event allow for route changes to facilitate the preservation of unique resources and otherwise minimize fireline construction impacts. In the wildfire situation heat and smoke result in a severe lack of visibility. A blow up-fire causes human emotions to dictate the most expedient route for fire trail construction. Natural or preexisting man-made barriers would be used where available. In a wildfire situation, a double blade width dozer line is typically used versus a narrow trail that would be used in prescribed fire situations. Another issue is the use of backfiring and burnout during suppression. Prescribed fire occurs under conditions that are favorable to control fire and to realize the desirable effects of fire. Burning operations during wildfires usually occur when extreme conditions exist and suppression forces are forced to take emergency action (attempting suppression of fire in an unnaturally high fuel bed under unfavorable weather conditions).

All prescribed fires would be reviewed for cultural, botanical and biological clearances or evaluations prior to burning. A Fire Management Unit (FMU) specific data sheet (see attachment 1) are attached to this EA, showing that each unit burned was in compliance with the State Historic Preservation Officer (SHIPO) and the Endangered Species Act (ESA). This Environmental Assessment (EA) would be modified by the Watershed/Landscape Analysis process as each analysis area document is completed. These modifications may be specific to the watershed or to this Fire Management EA as a whole. A 30 day public review period of all proposed prescribed burning within FMU's will precede each annual operation. All operations would be conducted by BLM personnel with interagency or contractual assistance.

Where a monetary savings and/or avoidance of environmental impacts would be realized, joint projects between private landowners, other federal, state, or local governments would be initiated through release agreement or interagency cooperative agreements.

Lands owned by private parties or administered by other federal, state, or local governments within the Klamath Falls Resource Area boundary would constitute five percent or less of the treatment area. These areas would receive the same environmental considerations and clearances as the public lands administered by the Klamath Falls Resource Area.

Where Pacific Yew is endemic within the Klamath Falls Resource Area all actions would follow the processes described in the BLM's Pacific Yew Policy. In the Resource Area, Pacific Yew is found in a limited number of riparian areas on Surveyor Mountain. All Pacific Yew trees would be protected when burning is planned in the vicinity.

The Mountain Lakes Wilderness Study Area (WSA) is exempted from all prescribed burning until Congress makes a decision on the merits of inclusion of the WSA into the National Wilderness System.

Design (features) strategies that must be common to all alternatives for the protection and avoidance of sensitive plants, animals, or special areas:

Clean Air Act

The Clean Air Act (as amended) requires compliance with State Regulations. This creates a dilemma in areas where prescribed fire is necessary for ecosystem health and maintenance because the desirable effects of fire are constrained by the impacts of smoke on human populations.

Compliance with smoke management and air quality laws and regulations may require close communication with state or local air quality authorities.

The Klamath Falls Resource Area would comply with the Oregon Smoke Management Plan and the Oregon State Implementation Plan. Monitoring and evaluation of resource area burning would follow process established by regulation and the Klamath volunteer smoke management process which includes peer review.

All FMU's would be treated in a manner or at a time that would protect all Class One Visibility areas, the Klamath Falls Special Protection Zone, the Medford-Ashland Designated and other Smoke Sensitive Areas. Burning would be conducted to prevent visual impairment or smoke intrusions.

Forest Ecosystem Management Assessment Team (FEMAT)

The following standards and guidelines from FSEIS volume 2, Appendix B-126, will prohibit activities that retard or prevent attainment of the Aquatic Conservation Strategy Objectives:

FM-1 Design fuel treatments and fire suppression strategies, practices, and activities to meet Aquatic Conservation Strategy Objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management activities could be damaging to long-term ecosystem function.

FM-2 Locate incident bases, camps, helibases, staging areas, helispots or other centers for incident activities outside of Riparian Reserves. If the only suitable location for such activities is within the Riparian Reserve, an exemption may be granted following a review and recommendation by a resource advisor. The advisor will prescribe the location, use conditions, and rehabilitation requirements and utilize an interdisciplinary team to predetermine suitable incident base, helibase or other incident function locations.

FM-3 Minimize delivery of chemical retardant, foam, or additives to surface waters. An exception may be warranted in situations where overriding immediate safety imperatives exist, or following a review and recommendation by a resource advisor, when an escape would cause more long-term damage.

FM-4 Design prescribed burn projects and prescriptions to contribute to attainment of Aquatic Conservation Strategy Objectives.

FM-5 Immediately establish an emergency team to develop a rehabilitation treatment plan needed to attain Aquatic Conservation Strategy Objectives whenever Riparian Reserves are significantly damaged by a wildfire or a prescribed fire burning out of prescription.

All actions will comply with Appendix B-8 (pages B 133-136) "Fire Management Standards and Guidelines" from FSEIS.

General Design Features

Protect soils and water quality by maintaining 1/4 inch of duff or litter layer on 50% or more of the treated FMU area.

Eventually, through a number of treatments, reduce existing fuel loads to fourteen tons per acre or less. The priority areas for treatment would be low and mid elevation, dry aspects that would have had a higher historic fire frequency.

Use natural fuel breaks whenever situations allow. Minimize size and impact of constructed fire lines.

Protect historic and cultural resources as required by:

* Public Law 101-601 Native American Graves Protection and Repatriation Act.

* National Historic Preservation Act of 1974 (NHPA), as amended 1980, 1992 - Executive Order 11593, implements NHPA.

* Archaeological Resources Protection Act of 1979, as amended, provides for protection of cambium peeled trees, structures, and cultural plants.

Create and maintain buffers (defensible fuel breaks) around District Designated Areas (DDA); i.e. unique resources, Spotted Owl Nests, etc. This provides protection to threatened and endangered species that are not fire adapted, as required by the Endangered Species Act.

A comprehensive Escape Fire Situation Analysis (EFSA) process has been developed for use on wildfires. Provide training for an adequate number of Resource Advisors (Environmental Specialists) on the updated needs for resource protection.

Follow guidance in the "Interim Watershed Practices Guide" (attachment 2) for the Klamath Falls Resource Area.

Minimize delivery of chemical retardants, foam or additives to special areas (RNA's, ACEC's). Where the plant community is the value for which the area is managed.

Description of the Alternatives

In order to better understand the description of alternatives, some definitions are in order. The term "Fire Intensity" as defined in this document has several meanings. There are two heat pulses that affect biological and physical elements:

Flaming Combustion occurs as the fire front passes. The time required for fire passage is called the "residence time". Residence time is generally short, however the degree of heat may be quite high.

* Fire line intensity = BTU/foot of flaming fire front/second
* Heat per unit area = number of BTUs emitted from a square foot of flaming fire front.
* Reaction intensity = measure of energy release expressed in BTU/square foot of flaming fire front/minute.

Glowing Combustion is the second heat pulse which often causes unseen effects. These effects are not noticed for one to ten years after a fire. Consumption of duff and larger fuels are indicators of the latent heat caused by glowing combustion. The heat of glowing combustion is lower when compared to the flaming front. The time that vegetation and soils are subjected to the heat of glowing combustion is much longer than the residence time of the flaming front.

Quantitatively, fire severity is a better overall criterion of the importance of fire than is fire intensity. The term "Fire Severity" defines the end result (effects) of fire intensity on biological and physical elements. Severity comprises the aggregate effects, short-term and long-term: intensity is an expression of transitory rate of heat generation. Fires of quite low intensity can have disastrously severe effects, but fires with high intensity are not necessarily severe as to degree or persistence of damage to the site. There are three factors to consider when evaluating fires; the amount of heat generated, the time that vegetation or other physical elements are subjected to the heat, and seasonal plant phenology or characteristics of the physical elements.

All fires have the capacity to create similar impacts. The main difference between the Alternatives is the degree of fire intensity or the severity of fire effects.

Alternative A. Prescribed Fire/Management Ignition (Preferred Plan)

Prescribed fire is the application of fire to wildland fuels in either their natural or modified state, under specified conditions, to allow the fire to burn in a predetermined area while producing the fire behavior required to achieve certain management objectives. There are two types of prescribed fires: Management Ignited and Prescribed Natural (Ignition) Fire.

Management Ignition (MI) prescribed fire is intentionally ignited to accomplish management objectives in specific areas under prescribed conditions identified in approved fire plans (time, season, weather conditions, location and firing technique selected by BLM). All prescribed burns are planned and authorized events.

The following FMU areas would be burned in the next two years:

* Included are the areas previously analyzed in EA number OR-014-92-13, dated 1992, section seven ESA consultation on March 3,1993 and concurred by U.S. Fish and Wildlife Service on April 22, 1993.

* Also included would be areas previously burned within the last ten years and addressed in previous EAs. Numbers OR-010-88-3 (Northern), OR-010-89-64 (Butte), and OR-010-89-90 (Topsy I).

* Unentered areas that would be burned under this action include: Webber Eagle Habitat Area, Wilkerson Horse Camp Units, Livingston, Swan Lake Rim, Bly, Surveyor Mtn., and others (See Table 2).

The ideal burning process would be numerous small fires scattered throughout the FMU. Few ignitions would burn together, hence 40% of the area would be burned. The operational difficulty of the process in an unnatural fuelbed would make the desired mosaic difficult to achieve.

After the first two years, FMUs would be selected for burning by a random process. FMUs for five years would be selected using a random number generator (or table) and grouped together for each years operational area. Approximately 2,700 acres would need to be treated on an annual basis to maintain the historic fire frequency level through the next decade. The number of annual acres could vary considerably due to the selection and review process. Proposed sites would be reviewed annually by a interdisciplinary team (IDT) and the public for correct timing, weather and seasonal conditions to produce desired management results. This review is to assure that all clearances (i.e. cultural, botanical, biological) are completed for each unit selected for burning. The IDT process may recommend specific areas for prescribed fire or may cancel the ignition in an FMU with written justification (concurrent restoration work, legal constraints such as timber sale contracts, ESA constraints, air quality, cultural sites or physical constraints such as small isolated tracts) are valid reasons for delaying ignition. The cancelled FMU is returned to the pool and may be selected during the next round.

Management ignition would permit prescribed fires within the areas of fragmented land ownership patterns. This alternative would provide the lowest risk of fire damage and escapement over time. This alternative conforms with the BLM's ecosystem management objectives. Reintroduction of fire within acceptable ignition times would provide desired ecological results and create a stepped reduction of fuelbeds. Reintroduction of fire, using restoration burns, would use 2 to 3 treatments within a ten year period (1 to 2 would be spring burns). These areas would then use one fall or summer maintenance burn selected by random process on a 5 to 15 year cycle in lower elevation Ponderosa Pine zones. A 10 to 20 year cycle (mid elevation) for Ponderosa Pine and Douglas Fir mixes (Mean Fire Interval (MFI) of 15 years for all Ponderosa Pine dominant communities) and a 30 to 50 year cycle for White Fir/Douglas Fir and Red Fir communities (MFI of 40 years). Grasslands and Oak/Juniper woodlands would be burned during seasons characteristic of the historic fire occurrence, at a MFI of 25 years. The random selection process would produce a wide variation of fire interval, which is an essential component that ensures diversity.

Restoration burns would typically use line source firing (ignition) techniques and maintenance burns would closely mimic natural occurring fire by using point source firing (ignition) techniques.

FMUs would be burned to achieve a mosaic pattern of burned and unburned areas. The mosaic pattern would ensure that avoidance species would have refugia.

Maintenance burns would be either management ignitions (MI) or natural ignitions (prescribed natural fire) provided they are within acceptable fuel, weather and seasonal conditions. Intense wildfire would still occur in FMUs where full restoration has not occurred (the undesired fire effects would initially be unchanged). After FMUs are treated, fire effects would reflect a less severe pre-settlement nature.

There would be some limited areas of special treatment. Sensitive areas such as along scenic routes, some RMAs, critical areas near Rural Interface Areas (RIA), sensitive soils and sites where fire intolerant T&E species occur, would receive manual or mechanical piling. Where mechanical piling is prescribed, a grapple equipped low ground pressure excavator would be used. The piles would be burned under conditions that encourage favorable smoke dispersion. Treatments are designed to lessen effects of fire from atypical fuel beds.

Site specific mechanical treatments used (not part of this EA) for fuel reduction, forest health improvement, or site preparation may be concurrently developed and would be addressed in EAs specific to those additional actions. All unplanned and unauthorized ignitions would be suppressed following guidance in the FMAP. Some natural ignitions would be allowed to burn under planned and authorized Prescribed Natural Fire Plans (PNFP). Guidance for PNFPs would be contained in the Resource Area Prescribed Fire Operational Guide (RAPFOG).

The effects of this alternative are described as low intensity, low severity fire.

FMUs scheduled for 1995-96 total 5000 acres with the understanding that 2000 to 5000 acres might actually be burned. After the first two years, approximately 2,000 to 3,000 acres of annual MI prescribed fire is possible, depending on FMU selection, weather, resource review and/or funding constraints. Acres treated by PNF would vary, influenced by drought, policy, current national wildfire load and the probability of appropriate natural ignitions. See Table 2 for 1995 and 1996 Burn Units.

Alternative B. Prescribed Natural Fire/Natural Ignitions

Prescribed Natural Fire (PNF) is a fire ignited by natural means (usually lightning). It is permitted to burn under specific environmental conditions, in pre-planned locations with adequate fire management personnel and equipment available, to achieve defined objectives as defined in an approved fire plan.

Table 2. 1995 and 1996 Burn Units

Legal	Type	Area	Name # Units	
South Bly	37-14-4,5,9,10+36-14-28	UR#1/2	150 "	( )
Livingston	38-13-25 & 26	UR#1	120 "	( )
Paddock-Norcross				
	38-14-30,31+38-13-25,26,27,28,33,34,35,36	UR#1	1675 "	( )
Topsy 1	40-6-35	UR#2	150 "	(5)
Wilkerson	38-13-33	UR#1	73 "	(3)
River Edge	41-6-3+40-6-24,33,34	UR#1	80 "	(1)
Yainax Butte	37-12-26,27,34,35	UR#1	423 "	
(2)140X				
Tunnel Creek	38-5-23	UR#1	27+ "	(1)
Wild Gal	41-5-7	UR#1/B	160 "	(1)
Dixie 3 & 4	41-5-5	UR#1	156 "	(2)
Wild # 10	40-14 1/2-1,2	UR#1	11 "	
(1)X				
Swan Brushfield	37-10-3,4,5,6,9,10	B	300 "	(1)
Timber Hill	40-15-29,31,32+41-15-3,4,5,6,7,8,9,11,17,18,19,20,21+			
	41-14 1/2-1,2,10,11,12,13,14,23,24	UR#2	900 "	( )
Johnson Headwaters	38-5-21,28	UR#1	90 "	(1)
Estates Subdivision	37-11-26,27,34,35			
	38-11-1,2,3,10,11,12,13,14,22,23,26,35	UR#1	2840 "	( )
Hamaker Canyon	40-13-8	UR#1	311 "	(
)XW				
Bryant Mtn.	40-12-12,13,24+40-13-7,17,19	UR#1	111 "	
(4)XW				

Webber Road (5)W	40-11-5,5,7,8	UR#1	200 "	
Clover Butte	38-6-24	UR#1	50 "	(1)
Grizzly Mtn.	40-5-31	UR#1	220 "	( )
Saddle Springs	39-6-9	UR#1	200 "	( )

Acres listed are within 10% of actual, plus or minus.

Abbreviations
Types of burns
UR = Underburn for Restoration, First 1 to 3 burns to reduce fuel loads.
UM = Underburn for Maintenance, Fire applied to mimic natural frequency.
B = Broadcast Burns on non-forested sites, for either Restoration or Maintenance.

EA Units
X = Covered under EA OR-014-92-13 with Section 7 ESA consultation completed
W = EA OR-014-94-12

The areas selected for this event are reviewed in the IDT and public scoping process. Each FMU is a planned event but the ignition is a random occurrence. Fragmented ownership patterns would restrict use. Confinement due to human barriers (i.e. roads, etc.) would further reduce effectiveness. Low intensity fires would not cross these barriers and higher intensity fires would often be outside prescription restraints. Unnatural fuelbeds would place these prescribed fires at a medium to high risk of escape. The reintroduction of fire using only natural ignition, although within acceptable weather and seasonal conditions, would produce multiple seral stages. The one time restoration burn (due to unnatural fuel loads) would result in a high intensity burn. This alternative would allow fires to burn whenever natural ignition occurs, during any season, provided acceptable parameters exist. Once the prescribed fire is burning outside the acceptable parameters, it would be suppressed as a wildfire. Wildfire would still occur. Under this alternative the undesired effects of both high intensity wildfire and prescribed fire would be classified as moderate to severe. Short term fire effects of prescribed natural fire are described as medium to high severity. It is estimated that within two centuries prescribed natural fire could possibly result in low intensity fire and associated low severity effects.

Alternative C. No Action/Wildfire

The no action or wildfire alternative is the continuation of the recent past and present situation. Unplanned lightning or unauthorized man caused fire will occur randomly. The fires burn in unnatural fuelbeds causing resource damage that is not typical of pre-settlement times. The occurrence of these fires is often during most extreme burning conditions. This alternative has the highest fire intensity, fire severity, and greatest risk to life, property and resources over time as demonstrated in the recent past.

Fires would impact all ownerships in fragmented land patterns. All wildfire (none of which would be prescribed fire) would be suppressed as soon as possible, at all times, in all places. Under this alternative any prescribed burning would be project specific, requiring a separate EA. The high intensity wildfires that occurred during 1992 (Lone Pine, Round Lake, Robinson Springs, John Springs, etc.) in South Central Oregon are examples of what can be expected in the present and future with this alternative. The 1992 wildfire exhibited a range of effects, the majority of which would be classified as high severity.

Alternative D. Mechanical/Whole Tree Utilization/Pile Burning

The mechanical alternative is alteration of fuel by compaction or removal. There is no corollary event in nature. This alternative has the lowest risk from management fire and the highest risk of site degradation. This system uses Biomass harvesting (whole tree utilization) and mechanical site preparation methods in conjunction with pile burning to remove fuel from the site. This alternative will never equate to fire because the side effects of application cause more long term damaging effects than any occurrence of wildfire. Soils are compacted and displaced, which cannot be fully mitigated.

Wildfire would still occur under this alternative. The undesired fire effects would be reduced initially. Not all excess fuels are removed and the compaction of fuels only reduces fuelbed depth. In time the fuels would build up and the undesired fire effects would return (provided that another disturbance does not occur). Site specific prescribed fire application (other than pile burning) would be less emphasized as a management option. Project specific EAs for Whole Tree Utilization Timber Sales, reforestation site preparation (where all areas are scraped clean) and bulldozer crushing of pre-commercial thinning slash are examples of the combined actions that make up this alternative.

Alternatives Considered but Dropped From Further Analysis

The construction of fuel breaks throughout the forest or using existing roads as the pattern of deployment is a cross between Alternatives C and D. The effects within the fuel break fit Alternative D. The majority of lands would be impacted with high intensity fires and with the severe fire effects of Alternative C.

Fuel breaks are effective only if adequate numbers of personnel have sufficient time and favorable weather conditions to ignite a successful backfire or burnout. Under extremely windy or unstable weather conditions prolific spotting (burning embers transported by wind or fire convection) would negate or compromise the fuel break resulting in continued fire spread.

A Resource Area Prescribed Fire Operational Guide (RAPFOG) would be developed for the selected alternative which would discuss the prescribed burning operation in greater detail.

Environmental Consequences

Results of Past Prescribed Fires and Observations on Past Wildfire Occurrence

The Klamath Falls Resource Area has conducted prescribed underburns on an annual basis since 1980 (except 1982) and has acquired considerable experience in prescribed fire application. Information in the previous sections and in the "effects" section that follows includes the BLM's experience (5736 acres were burned during the period 1989 to 1993).

From past prescribed fires, it has been learned that a 50% average reduction of fuels from each burn is typical. The mortality from prescribed burning is indistinguishable from the mortality associated from drought. Some mortality in overstory trees is expected (5% to 30% related to duff consumption or drought). The amount of duff consumption is related to moisture in the lower layers of the forest floor. The rate of spread and the fireline intensity is reduced in previously burned prescribed fire units. For example, previous prescribed burning facilitated the suppression of unplanned wildfires that occurred during the worst weather conditions on the Fort Spring, Kitts Mill and Paddock Fires. The BLM has developed a better understanding of the wildfire resistance that can be achieved from prescribed fire. Prior to underburning, fuel loads in the Ponderosa Pine forests of the Resource Area averaged 61 tons/acre. Units underburned one time average 23 tons/acre. A wildfire in one of these once burned units resulted in complete overstory loss, demonstrating that future additional burn treatments are required to lower fuel weight to a level where the overstory will survive wildfire, which is less than 14 tons/acre.

A mosaic burn is easier to achieve if burning is done over a large area. In the spring or when dry weather is expected, specific burn areas require firm confinement areas. The firelines that form the perimeter of confinement may be natural or man made. When drying conditions exist and the desired result is to have a mosaic burn pattern, careful daily patrol is required. It is generally found better to establish the mosaic with control lines or natural breaks. A mosaic pattern can be achieved, or as a minimum the preservation of refugia for endemic species.

The intensity of a fire is not synonymous with the severity of the fire. BLM has experienced fires that have appeared to be of low intensity, but due to extreme consumption of duff and concentrations of larger round fuels, have exhibited very severe site and plant effects. Almost all the Resource Area's past prescribed fires were low intensity with low to moderate severity. Less than one tenth of the prescribed fire area completed in 1992 (a very dry year) were classified as high severity.

Classic examples within the Klamath Falls Resource Area of the differences between low-medium-high intensity and severity fires are shown in Table 3 (wildfires are an example of alternative C).

Environmental Consequences of the Proposed Action and the Alternatives

Alternative A is represented by low intensity fire with low to medium severity effects. Alternative B is between low and high intensity with the greater number fires being high intensity. The severity of Alternative B fires would range between medium and high. Alternative C would subject the greatest area to high intensity and high severity fire, however other intensity and severity levels would also be present. Alternative D would cover all ranges of fire intensity. Alternative D's effects are not common to any of the other alternatives.

The preferred alternative (A) would return vegetation and fuels to within sustainable structure, function, and composition without the loss of present overstory. The typical fire regime in long needle conifer forests consists of a dry climate with a long fire season. There is ample time each year for fuel to become highly flammable. The forest understory is open, permitting rapid drying of fuel and wind access. The fuels are quickly dried and available to burn during most of each fire season. The fuels support rapid spread of mostly low-intensity fires. Lightning starts more than 25 fires per million acres per year.

Table 3. KFRA Intensity and Severity Examples

Name of Event	Intensity	Severity
Bryant Mountain - 1979 (logged post fire and seeded)	H	L (5%), H(95%)
John Springs Fire - 1992 Area logged pre-fire. Area untreated. Area logged 1977 within Proposed ACEC. Area untreated in Proposed ACEC (example of Alt. B).	 L-M-H H H M, H	 L (30%), M(60%),H (10%) H M (20%), H(80%) M(40%), H(60%)
Paddock Fire - 1992 1989 Original Underburn (1st Restoration Burn only, 2-3 burns are required to reach maintenance levels) Wildfire in burned area.	 L H	 L H
Kitts Mill Fire - 1987 1986 Original Underburn (1st Restoration Burn only, 2-3 burns are required to reach maintenance levels) Wildfire in RX burn area. Wildfire in Non-Rx area.	 L M H	 M M H
Fort Spring Fire - 1992 1985 Original Underburn (USFS 1 burn) Wildfire in RX burn area. Wildfire in Non-Rx area.	 L H H	 L H H
Gerber Underburns (examples of Preferred Alternative) Spring 1989 Spring 1990 Spring 1992	 L L L	 L L(90%), M(10%) L(50%),M(40%),H(10%)
H = High, M = Moderate, L = Low		

Past history demonstrates that at lower elevations Native Americans burned on a regular basis. Pine litter and herbaceous vegetation usually are the main supporters of fire spread. Bitterbrush and snowbrush would cause higher intensity in spots, or on the landscape as a whole. Down woody material and stumps burn persistently. Thickets of reproduction may burn with high intensity, but larger trees are seldom involved.

Following restoration prescribed burns, successive natural fires would burn any given area at relatively short intervals. Fire is possible in any year; burning is not well correlated with drought years. The length of interval between fires is essentially random within limits. Typical mean fire return intervals tend to be 15 to 40 years in forests within the Resource Area (depending on elevation, aspect, and plant association). Most fire-free intervals at lower elevations fall in the range of 3 to 25 years. Frequently an area burns two years in a row or escapes fire for 30 years. Fires that occur after a long interval are very severe. Successive fires, especially at the shorter intervals, do not necessarily cover exactly the same area. Ponderosa Pine stands will be impacted severely by wildfire when the fire free period is near twenty years.

The effect of prescribed fire at the proper MFI is to maintain the status quo within flexible limits. Fuel succession has a short time interval. Each fire reduces the amount of available fuel. Much of the accumulated fine fuel is consumed by each fire and very little fuel accumulates before the next fire. Large fuels are consumed progressively by successive fires. Natural mortality and downfall of old trees is slow and scattered. Where patches of old trees die it is generally a result of insects and blowdown. Non-arboreal components are recycled periodically. Grasses and possibly some forbs are stimulated by removal of litter and conversion of organic matter to usable form. Sprouting and seeding of shrubs are stimulated somewhat selectively. Gradual replacement of the dominant, fire resistant trees with like species occurs. Fires are not intense enough to kill mature trees. Fires spare occasional seedlings of fire resistant species, which fill in openings caused by mortality of dominants. Fires are frequent enough to eliminate reproduction of less resistant species.

Mixed Douglas Fir/Pine forests would have a mix of species where frequency of fire determines the composition of the forest. Ponderosa Pine constitutes the majority of the mix. Shasta Fir stands have a wide range of MFI, the average being 40 years. Shasta Fir regenerated best under moderate intensity and severity fires.

The effects of Alternatives B and C would be similar and are best described as returning understory and overstory vegetation to beginning seral stages.

Fire Effects on Vegetation

The vegetation native to South Central Oregon has flourished with frequent fire intervals. Plant characteristics or adaptive traits that allow survival have developed through time with repeated exposure to fire or other disturbance. These traits include bark thickness in Ponderosa Pine, special seed characteristics in some brush species or the ability in some species to resprout from the roots. Entire plant communities and landscapes have developed or were a direct result of the occurrence of fire. Specific species information is available in published literature.

Plant associations (the ultimate vegetation climax for a particular site under given climatic conditions) which are listed in this EA describe the future climax vegetation that would develop in the absence of disturbances such as fire. Most attributes identified with current plant communities (the vegetation which is maintained by reoccurring disturbance) are relics of historic fire maintained vegetation. Historic vegetation has also been influenced by global warming which has occurred since the last Ice Age (approximately 10,000 years ago). The period known as the Little Ice Age (15-19th Centuries) had a great influence on current overstory conifer populations. The warming associated with the end of this period of cooler temperatures assures that vegetation of a more xeric nature will prevail in the future. The realization that vegetation has changed dramatically over the last 10,000 years emphasizes the need to provide refugia so that all the components are available to cope with any future global climate change. Desired future condition within burn units would be the seral or climax stage, that would have developed without settlement disturbance and fire exclusion. Actions that simply return vegetation to that which existed at the turn of the century would not account for the changes in global climate that have occurred since that time.

Historical forests in the region have been discussed by a number of sources. Research papers abound discussing the effects of fire on vegetation. A "List of References and Suggested Reading" is provided at the back of this document. This is not to suggest that we know each integral response that might develop in every situation. The vegetation of the historic past is a sufficient example of what can be expected in the future. The response of plant species to fire at a particular time is dependent upon fire intensity, season of burn and genetic variability. Documentation often shows conflicting effects (see attached reference list). Included in the following paragraphs is a synopsis of general fire effects for plants of particular interest in the Klamath Falls Resource Area.

As a general rule, understory grasses and herbaceous plants will increase in number or percentage ground cover as canopy cover decreases. More understory vegetation occurs where little litter, duff, or down woody material exist. Any excess litter and down woody material is consumed by frequent surface fires.

Bitterbrush. Mature Bitterbrush is not a fire adapted species in senescence. However, there appears to be a period early in the life cycle where bitterbrush does resprout. However, once the plant passes a threshold age, fire will eliminate bitterbrush from an area except for isolated plants. Nearly thirty years will pass before new plants will cover the area. Mature, pine needle draped bitterbrush will contribute to particularly intense fires. The intensity of these fires tend to exceed the level generated by any previous fires. Recent accounts of fires where bitterbrush was in senescence report that, after the event, the ground was free of needle and litter accumulation for twenty years. Some new plants will start in bare ground areas from seed caches; fire will scarify the seed. No mention is made regarding the condition of any overstory cover that might have existed prior to the fire.

Mountain Mahogany. Mountain Mahogany has a response similar to bitterbrush. It was found in the rocky fringes where fire was less frequent, or as surviving individuals. An example of Mountain Mahogany response in the Klamath Falls Resource Area occurred after the John Springs Fire in 1992 at Yainax Butte. New Mountain Mahogany seedlings were observed in the burned areas the summer following wildfire.

Blue-leafed Penstemon. This plant resprouts after relatively low intensity fire. This behavior was observed within the Yainax Butte proposed Area of Critical Environmental Concern (ACEC) after the John Springs Fire in 1992.

Ponderosa Pine. This species survives low intensity ground fires where duff and litter layers have not accumulated to excessive amounts. After deep duff beds are established, restoration is a difficult process. The resulting root structure is sensitive to duff fires that cover a high percentage of the root spread area. If, after a severe fire sufficient amount of root overlap is damaged, the pine community will not compensate for the individual and that tree will be stressed or killed. Stressed trees are often subjected to insect (bark beetle) attack or disease attack and may die. This was a normal course of events prior to fire suppression, however now a higher percentage of the stand is affected. Compensating that situation is the fact that existing stocking levels are often considerably higher than levels in historic times. Pine is most susceptible to fire in early and late stages of life.

The presence of ladder fuels or multistoried stand conditions often complicate the restoration process. Restoration burning, if attempted, needs to be conducted carefully to avoid the loss of prized large, old individuals in senescence. During active growth periods crown scorch does weaken trees. Bark beetles would be active in the more severely defoliated trees causing mortality. Trees are less susceptible to bark beetle attack after fall burns.

Douglas Fir. Although this species is less resistant than Ponderosa Pine, Douglas Fir is still considered a fire adapted species. In associations where Ponderosa Pine is seral and Douglas Fir climax the fire free interval determines the mix or absence of either or both species.

White Fir. Clumped patches of white fir reproduction do survive an occurrence of low intensity fire, as do most mature trees. Literature points out that repeated application of fire will effectively reduce numbers of white fir. Historical accounts demonstrate the distribution and frequency of white fir at higher elevations in the Cascades. Lower elevations also had populations of white fir but at considerably reduced numbers and cover.

Western Juniper. This species is very susceptible to fire early in life when in grasslands. It is susceptible at all times in brush fields. Mature juniper is fire resistant and the elimination of fine fuels restricts fire spread. Fire frequently regulated the historic area occupied by juniper. The lack of fire in more recent times has resulted in many acres of grassland being converted to juniper woodland. Within present day woodlands juniper competition allows very little grass to grow, consequently fire alone would not be able to reduce large juniper. However, severing juniper first and then burning would restore grass cover over a period of time.

Quaking Aspen. Quaking Aspen sprouts profusely after fire when grazing is properly managed in riparian areas. The greatest problem is the reluctance to burn aspen until it is dead. Dead trees do not sprout. Another problem is that current fuel loads in Riparian Management Areas (RMA) are typically so heavy that fire severity may be well beyond pre-settlement levels.

Noxious weed infestation would be mitigated along fire trails by using the smallest width line as is practical given the burning conditions at the time of fire occurrence. Alternative A would have lines 2 to 8' wide. Alternatives B and C fire lines would be constructed from 2 to 36' wide with 13 to 16' typical. Alternative D will dramatically increase noxious weeds by subjecting large areas to mechanical surface disturbance.

This section describes the fire maintained plant communities that would cover the largest area. Other plant communities would exist but the area they would cover would be small and are not addressed specifically.

Pine Savanna Plant Community (CP-C2-11) Ponderosa Pine - Juniper / Mountain Mahogany - Bitterbrush / Fescue. The current community has a high coverage of Western Juniper. Target conditions would have a mosaic mix where Western Juniper occupies the rocky ridges, scree, and other areas where fire on a 15 - 30 year interval would not reach. Ponderosa Pine would cover 5 to 30% of the overstory as scattered individuals or clumps. Mountain Mahogany and Bitterbrush would cover the areas in between. Squirreltail and Fescue grass would also be present in high numbers.

The Pine Savannah Community would transition along the lower elevation ecotone into a Low Sagebrush - Goldenweed/Bluegrass Community (SD-92-11) in which relatively few Junipers would exist except an occasional individual or clump in rocky or barren areas free from fire disturbances. These lithosol cultural plant communities are enhanced by fall fires.

The Pine Savannah would transition at upper elevations into a Ponderosa Pine/Woody Wyethia (CP-F1-11) or the lower Ponderosa Pine Community. Ponderosa Pine would have 30 to 60% of tree cover and White Fir and Western Juniper would exist only as scattered individuals in rocky or wetter locations where the frequent low intensity surface fires (5 to 15 yr) would not reach. Forbs and grass would dominate understory.

Ponderosa Pine Climax Plant Communities MFI = < 15 years

Ponderosa pine / wooly wyethia (CP-F1-11)

Ponderosa pine - juniper / mountain mahogany-
bitterbrush - big sage / fescue (CP-C2-11)

Above the lower Ponderosa Pine community the White Fir - Ponderosa Pine/Snowberry/Starwort (CW-S3-13) or high Ponderosa Pine Community. This community would be dominated by Pine with White Fir represented by 0 to 10% of numbers of total cover. Frequent fires (10 - 20 years) would maintain an understory cover of forbs and grasses.

Two associations are classified as Mixed Conifer. Mixed Conifer/Snowbrush - Squawcarpet/Strawberry (CW-S1-16) which typically occurs east of Highway 97. Fire would maintain a high percentage of cover of Ponderosa Pine in comparison to White Fir and Douglas Fir. Fire intervals would range from 15 to 30 years. Longer intervals between fires would increase the cover of White Fir and Douglas Fir. Sugar Pine is also present. Ponderosa Pine and Sugar Pine would dominate many sites. Low brush, forbs and grass would dominate understory. Fires would keep the height of the brush below the knee.

The version west of Highway 97 is Mixed Conifer/Snowbrush - Bearberry (CW-C2-16). This site would be a mix of species, dominated by Ponderosa Pine, Douglas Fir and Sugar Pine. White Fir and Incense Cedar would be present in most stands in relatively small numbers. Knee high brush, forbs and grass would dominate the understory. The cover of Ponderosa Pine or Douglas Fir, as mentioned above, is determined by the Fire Free Interval. Shorter intervals (less than 20 years) would favor Ponderosa Pine, longer intervals (greater than 20 years) would favor Douglas Fir.

Fire Maintained Ponderosa Pine (seral) in
Douglas Fir or White Fir Climax communities
MFI = 10 to 30 years (longer MFI favors
white fir, mid range Douglas fir, short
ponderosa pine)

Mixed conifer/snowbrush/strawberry (CW-S1-16)

White fir-ponderosa pine/snowberry/strawberry
starwort (CW-S3-13)

White fir-ponderosa pine-incense cedar-
serviceberry (CW-C1-11)

Lower Elevation (upper elevation sites are shown on Figure 3) Mixed conifer/snowbrush/bearberry (CW-C2-15)

Above the CW-C2-16 is the Shasta Red Fir - White Fir/Chinquapin -Prince's Pine/Long Stolen Sedge (CR-S3-11) or Red Fir Community. Fire at the 30 to 50 year interval favors Shasta Red Fir while at longer intervals White Fir will increase. Shorter intervals favor Ponderosa Pine or Douglas Fir. Catastrophic fire in limited areas would increase cover by Western White Pine; larger fire areas would increase Lodgepole Pine. This community is a mosaic area where fires are typically moderate in intensity.

Many other plant communities exist in the resource area, but generally cover very small areas. Two types of communities, the sedge wet flushing meadow and the garland microhabitats, are important due to the number of cultural plants that grow within them.

Fire, therefore, is an ecosystem process that affects species composition, structure, and nutrient cycling regimes of plant communities typical of South Central Oregon. The ranking of alternatives from least disruptive of natural cycles to most distruptive, respectively, is: A, B, C, D.

Fire maintained red fir and mixed conifer plant communities.

Shasta red fir / long-stolon sedge (CR-G1-11)

Shasta red fir - white fir / chinquapin -
prince's pine / long-stolon sedge (CR-S3-11)

Shasta red fir - mountain hemlock /
pine mat manzanita / long-stolon sedge (CR-S1-12)

White fir / snowberry / strawberry (CW-S3-12)

White fir / chinquapin - boxwood -
prince's pine (CW-H1-12)

Upper Elevation / Mixed conifer / snowberry /
bearberry (CW-C2-15)

Fire Effects on Animals

Wildlife

Fire influences wild animals in two general ways, by direct mortality and by altering their habitat. The greatest concern of fires effect on wildlife is mortality resulting directly from heat or smoke. Most studies have concluded that direct mortality is uncommon because most animals have the ability to escape by moving or burrowing (Severson and Rinne, 1988). In situations where mortality does occur, areas are usually quickly recolonized by species moving in from other areas (immigration) or some animals (such as rodents and rabbits) have the capability to reproduce rapidly. If fires are initiated during periods when birds are nesting or mammals are producing young, then impacts could be detrimental to local populations. Many species of reptiles hatch out their young underground, so newly hatched and adult reptiles may not be affected by fire.

In areas where fire has historically been a component of the ecosystem, the benefits to wildlife habitat from prescribed fire would generally offset the short term negative impacts. Prescribed fire can improve habitats for wildlife by increasing plant diversity, the nutritive value and abundance of forage plants. Fire also benefits wildlife habitat by breaking up large homogeneous patches into smaller, more diverse mosaics and also creates "edges" which increases overall habitat diversity.

Burning small areas in short rotations (around 5 years) will create understory mosaics that will vary the vegetative production, composition, and nutritional value. The small areas that do burn hotter and kill the overstory component will create early seral stages attracting animals normally found only in those habitats, and thereby increase overall animal diversity. This type of regime benefits not only reptiles, amphibians, birds and small mammals, but big game species as well.

Big Game

In general, big game such as deer, elk and antelope respond well to recently burned habitat. Burned areas usually quickly produce an abundance of grasses and forbs. However, woody browse species that are burned and do not resprout can be damaged or totally burned and lost as forage for a long period of time. This can be a significant detrimental effect on big game winter ranges. This is why burning in mosaics is beneficial. Past prescribed fires in the Klamath Falls Resource Area, and those described under the preferred alternative, usually create a mosaic of burned and unburned. This mosaic would also create patches of habitat in a variety of successional stages, which would be a desirable condition for big game.

Hot, high intensity fires that ignite the forest canopy can result in loss of thermal and hiding cover. However, most spring and fall prescribed burns are done when the climate and habitat conditions aren't conducive to a crown fire. Again, if the loss of small patches of trees occurred, this creates a mosaic of habitat conditions within the forest stand and will benefit other wildlife species such as woodpeckers and have no significant effect on big game.

The actions described under the preferred alternative would likely benefit big game habitat and populations. Moving from alternative B through D, the benefits would decrease and the potential negative impacts increase accordingly.

Small Mammals

The habitats created by prescribed burning favor some animals and discriminate against others. Small burrowing mammals such as rodents and others are not likely affected by low intensity fires as they would be with high intensity wildfires. Fire could adversely affect the abundance of dead and down material used by these species for resting, feeding, reproduction, or escape cover. However, as stated previously, if populations were depleted, many have the capability to recover quickly. Overall, if the prescription is applied carefully, controlled fire can produce a desirable mosaic of conditions that could enhance habitat diversity for small mammals. Impacts to small mammals and their habitat would be low under the preferred alternative and in some cases, would be beneficial. Any other alternative would increase the potential impacts.

Fish and Amphibians

The effect of prescribed fire on stream habitat is generally not significant or detrimental to the aquatic ecosystem. A possible direct effect would be heating of the water but this would likely only occur on small segments of a stream or reservoir and the likelihood of severe damage would be low. Potential indirect effects of a high intensity fire could be soil erosion from increased water flow over the watershed, increased sedimentation and nutrient loading in the stream, and removal of streamside vegetation. However, nutrient increases are not usually toxic and benefit primary and secondary production in streams. Introduction of fine sediments into a spawning stream could severely reduce spawning and rearing substrate for salmonids (Minshall, et. al. 1989). However, under prescribed burning, fire intensity, spread, and duration is controlled and would significantly reduce the potential impacts. Wildfire would have severe detrimental effects to stream habitat; those impacts discussed above would be the primary cause to habitat destruction from an uncontrolled fire.

One study (Wright and Bailey, 1982) suggested fire increases streamside deciduous vegetation and provides increased cover and food supply for fishes. Of course under large wildfire situations the effects could be severe and cause long lasting damage. Brown et. al. (1985) suggests to avoid burning sequences that would damage more than 20 percent of streamside vegetation in salmonid bearing streams. The effects of fire (specifically prescribed fire) in streamside/riparian habitats has not been specifically addressed in research studies; more study is needed to be able to predict the exact benefits or negative impacts.

Trout

Because burning conditions are controllable, it is expected that the preferred alternative would have little or no impact, or possibly beneficial results to trout habitat and streamside habitat on trout bearing streams. Impacts would be increasingly greater under Alternatives B, C, and D.

Endangered Suckers

The discussion above is generally applicable to shortnose suckers that spawn in streams that are tributary to Gerber Reservoir on the east side of the resource area. Because components of sucker spawning habitat on the east side has not been studied and critical components identified, the specific impacts cannot be predicted. However, the habitat that trout use for spawning in tributaries of Gerber Reservoir and on west side streams are similar for endangered suckers, so those impacts described above for trout are also applicable to sucker spawning habitat. Shortnose and Lost River suckers generally reside in reservoirs prior to spawning, so impacts to those habitats would be little or none under the preferred alternative.

Amphibians

Nearly all amphibians occurring or potentially occurring in the resource area are dependent to some degree on riparian/streamside habitat. Although species like western toad and roughskin newt are found in forested upland areas away from the riparian zone, they must have ponds, lakes or slow moving streams for breeding. Impacts to amphibians would be similar to those discussed above for trout habitat, but specific impacts would be based on conditions at the particular site where these animals occur and the conditions of the prescribed burn. Many of these animals would be able to burrow into the ground or moist substrate that would protect them from fire. Because research literature on specific impacts to amphibians is lacking, it is not feasible to accurately predict the site specific impacts to this group of animals.

In general, impacts from the preferred alternative would be the lowest and impacts would be increasingly greater under Alternatives B, C, and D.

Birds

Neotropical Migrants

The effect of fire on small migratory songbirds (neotropical migrants), both nesting and non-nesting, would depend on a multitude of site specific conditions and the outcome of a particular prescribed burn. As stated previously, habitats created by prescribed burning favor some animals and discriminate against others, and this applies to birds. However, some generalizations can be made. Most literature indicates that in general, fire is probably more neutral than beneficial to birds. Fire would likely have the greatest effect on those species sensitive to structural habitat features. For example, in the long-term after a fire, an increase in ground foraging and nesting species may result from an increased understory; in the short-term, however there would be a reduction in species dependent on this habitat type due to loss of nesting and perching substrate. Burning may improve birds access to seeds and other foods but an adverse effect may be the loss of resting and escape cover afforded by cull logs and other down woody debris. The bigger the area is that receives treatment, then the greater the potential impact, whether good or bad.

In general, the burning methods described under the preferred alternative that creates mosaics and doesn't burn large acreages at one time would be the least destructive to these birds. The other alternatives would have an increasingly unknown or negative effect from B through D.

Snag Dependent Species

Woodpeckers and other cavity nesting species are dependent on snags for foraging, roosting, nesting, and other functions. In wildfire situations where a crown fire kills many trees, lots of snags are created and snag dependent species benefit greatly. Years later under prescribed fire conditions, these same snags could be burned by a ground fire and a significant loss occurs to species needing snags. In one case, a single prescribed burn described as "moderately intense" burned nearly half of all ponderosa pine snags with DBH of greater than 6 inches (Horton and Mannan 1988). Most those burned had large amounts of loose, relatively undecayed woody debris at the base. This shows the importance of making a special effort to line snags and protect them from a repeated burning program.

The occasional total burning of small patches of conifer that could occur under the preferred alternative will benefit cavity dependent birds and other species of wildlife. The other alternatives could have a detrimental effect to snag dependent species with the greater effect going from Alternative B to D.

Eagles

Bald and golden eagles require large live old growth pine or Douglas-fir for nesting (golden eagles will use snags) and generally, dense stands of late successional conifers for winter roost sites. Prescribed burning will not likely have any effect on existing large nest trees due to the resistance of large old trees to low intensity fire. Smaller pole size trees may be killed by fire but generally are replaced within a stand that is managed for an uneven aged canopy.

Impacts on eagle habitat from the preferred alternative would be the lowest and impacts would be increasingly greater under Alternatives B, C, and D.

Spotted Owls

Impacts of fire would vary in spotted owl habitat on the west side of the resource area. Underburning would reduce the chances of a catastrophic stand replacement type fire. Prescribed burning could also benefit the owls prey base by stimulating undergrowth (forbs and woody species) that is beneficial to rodent populations; and burning could eliminate dense slash and make prey more available. On the negative side, an underburn would likely eliminate most wood rats (a primary prey item of owls in the resource area) and their nests that are made up of small woody material.

Fire suppression to date may have increased the amount of dense forest stands on the west side and species such as the spotted owl and pileated woodpecker have been the benefactor in this situation. Total owl numbers may have increased as a result, but their range has likely not increased accordingly. The desired direction for owls is towards historic conditions but not necessarily to a ponderosa pine dominated mixed conifer stand. These owl inhabited stands need to be managed for a diversity of wildlife species, not specifically for one species.

Impacts on spotted owl habitat from the preferred alternative would be the lowest, and impacts would be increasingly greater under Alternatives B, C, and D.

Invertebrates

The effects of fire on invertebrate populations vary; they may be brief or long lasting. In general, invertebrates decrease in numbers because they or their eggs, along with their food supply and shelter, may be destroyed by fire, depending on its duration and intensity. Under the preferred alternative, impacts to invertebrates would be the lowest and would increase incrementally moving from alternative B to D.

Fire Effects on Soils

The following is a summary of information describing effects of fire on soil.

Fire is variable in the system. Fire intensity and related severity can vary from one fire to another. The duration of heating can affect the reaction of soil to fire. Fire frequency in the forest is variable depending on forest type and management activities.

Soil type can vary as well as fire behavior. The age of the parent material of the soil will determine the soil type in a given climate. Plant cover and climate will modify the parent material to create a unique soil in a given environment. Therefore, fire effects on soils will vary relative to soil type. Fire effects can be roughly predicted from current knowledge of fire behavior and soil types.

The lack of fire has increased the amount of organic debris on the soil surface which in turn increases carbon to nitrogen ratios. Much of the nitrogen in the forest floor is tied up in the decomposition process of the excess woody debris. Total nutrients on the site after burning, versus before burning, is lower due to volatilization. Fire helps break down nutrients from the organic state and makes them immediately available for uptake. However, available nitrogen becomes tied up with microbial activity (becoming unavailable for plants) if the plants do not absorb it quickly.

Volatilization of waxy substances due to extreme heating (associated with heavy consumption during extended periods of time) can cause hydrophilic layers in the soil that inhibit plant growth. The heating duration, temperature, litter and vegetation type are important factors affecting development of hydrophilic soils.

Fire can change clay minerals in soil. Clays will retain nutrients. Organic matter changes with heating, resulting in a distillation of volatiles. Heat induces rearrangement of nutrients and pH increases. Ash production is determined by the fire intensity and the subject fuel bed. Organic anions are lost, such as sulfates and phosphates. The impact of ash includes an increase of solution pH and soil pH. Soluble levels of nutrients and ions increase. Cation exchange capacity increases if the organic matter lost is not excessive. Ions may leach from the site.

The loss of elements by volatilization would take place as follows. Nitrogen is lost in relation to the amount of organic material consumed. Sulfur is also lost, but this can be replaced from soil resources. In severe fires, potassium and phosphorus can be lost. Sterilization is related to the temperature in the soil and forest floor. Regrowth of microbes is rapid and facilitated by movement upward from lower depths and airborne spores. Nutrients are more available after a fire and the growth of microbes may be enhanced.

Any factor that removes soil cover has the capability to increase erosion. The loss of cover can increase raindrop splash effects and cause increased overland flow. Evapotranspiration is reduced, potentially increasing water yield and storage. Soil anchoring by roots is reduced, but may not be evident for several years. Mass movement on steep slopes may increase because of a greater water load on the slope. The above described would be classified as severe effects.

Effects of fire on soils is variable but somewhat predictable. The effects are very site specific and as a result there are conflicting statements in literature. However, soils in the analysis area have been influenced by repeated fire occurrence. The interval varied but the fire intensity was low. Reintroduction of fire must mimic these events. If not, changes in soil properties would be expected. This would result in changes in species composition and relative abundance of species composing the vegetation. A radical departure in historic soil elements has occurred (due to biomass build up) with unknown effects on plant associations. The growth rate of tree species appears to have increased, however no information on the changes of lesser species has been documented. The impacts of increased litter and duff soil layers would place species that existed prior to fire suppression at a competitive disadvantage with species better adapted to the modified soils.

A good discussion of the impacts of alternative D is found in the Klamath Falls Resource Area draft Resource Management Plan, pages 4-9 through 4-12. In summary compaction from heavy equipment will increase surface runoff causing erosion and decreased vegetation productivity over the long term.

Impacts to soil are most severe to least severe in the following order: Alternatives D, C, B, A.

Fire Effects on Water Quality

Fire may affect the site in several ways and the effects will vary from event to event. Below are some common responses of water quality to fire events and a few observations specific to South Central Oregon.

Fire exerts pronounced effects on basic hydrologic processes, leading to eroding forces and to reduced land stability. This is manifested primarily as increased overland flow, and greater peak and total discharge. These provide increased force for sediment transport from the landscape. Scab rock flats tend to show more erosion even on relatively gentle slopes. Forested sites are more stable due to duff or litter cover. Post burn areas where crown scorch versus crown consumption has occurred, have sufficient cover (dropped dead needles) to retard sediment overland flow.

Erosion responses to burning are a function of several factors including: degree of elimination of protective cover, steepness of slopes, degree of soil non-wettability, climatic characteristics, and rapidity of vegetation recovery.

Sedimentation, increased turbidity levels, and mass erosion on steep slope appears to be the most serious threat to water resources following fire (especially severe fires). Elimination of protective streambank cover has been shown to cause temperature increases that could potentially pose a threat to aquatic life. Prescribed fire would affect smaller areas along streams versus an entire drainage totally impacted (which might occur during a wildfire). Steeper slopes occur only on a small percentage of the resource area and therefore mass erosion or mass wasting is not expected to be a concern.

Large fires of high intensity and severity appear to have the greatest potential for causing damage to water resources.

Fire causes rapid mineralization and mobilization of nutrient elements that are manifested in increased levels of nutrients in overland water flow and soil solution. Watershed studies, however, indicate that these additional nutrients do not impair the quality of surface waters for municipal purposes. Effects of nutrient losses via sediment and solution have not been related directly to site productivity, but in general do not appear to represent a sizeable proportion of total site nutrient capitals.

Fire-caused water quality changes were not shown to adversely affect composition or productivity of benthic macroinvertebrates but this is a poorly documented research area.

Following the "Interim Watershed Practices Guide" will provide protection to water resources.

Alternative A would affect water quality the least. Alternatives B and C would have great short-term effects with Alternative D having long-term effects. Affects on water quality could vary based on the intensity of fire disturbance.

Fire Effects on Riparian Management Areas

The concept that Riparian Management Areas (RMA) are to be protected from all disturbances guarantees that when a wildfire does occur, the RMA would behave like a wick. Fire suppression is restricted in RMA's. Unplanned and unauthorized fire would spread at will in the dry RMA's (RMA's burn severely when dry) and since suppression is restricted all lands upslope from the RMA will burn also. The safety of the fire fighter is the prime concern, hence entire drainages would be disturbed by a wildfire which would inevitably occur. Prescribed fire, as described in Alternative A, would be used to treat RMA's in a controlled manner (season, ignition method, etc.). Impacts of burning in the RMA would be minimized by treating only a small portion of any RMA at any given time and following guidance in the "Interim Watershed Practices Guide" (attachment 2).

Fire Effects on Air Quality

Smoke from prescribed burning and wildfire currently is the greatest single factor causing public concern. Smoke from prescribed burning is regulated by Federal Law and State Regulation. Severe smoke from wildfires in 1987 affected large areas of southern Oregon and northern California. Wildfire smoke has typically been ignored by state and federal air qualitiy organizations as if wildfire impacts were totally unavoidable. Actions can be taken prior to the wildfire event to reduce the impacts of smoke. Smoke from prescribed fire can be planned and directed, however this situation does not occur with wildfire. The amount of smoke emitted and its dispersion are affected by how and when a fire occurs. A slow-burning low intensity fire (alternative A) backing into the wind will emit less smoke per pound of fuel consumed than will a fast-spreading head fire (alternatives B and C).

High-intensity head fires, such as Alternative B or C, emit more particulates, carbon monoxide and hydrocarbons than backing fires do; emissions may also be dispersed upward in the atmosphere, whereas smoke from low intensity fires will drift along the ground. When fire is prescribed, atmospheric stability and wind direction are important considerations in avoiding excessive problems in smoke sensitive areas.

The major atmospheric problem caused by surface burning is reduction in visibility. Condensed vapor and particulates combine to form visible, generally white smoke which may obscure scenery and reduce visibility. The most efficient method of burning occurs under Alternative D followed by Alternative A.

Health problems can be caused by emissions of particulates, carbon monoxide, hydrocarbons, and nitrogen oxides. Since the amounts of these emissions that are tolerable vary with different situations, burning should be regulated as much as possible to avoid overloading natural atmospheric clearance mechanisms.

Carbon monoxide levels drop rapidly to nearly normal levels just outside the fire area. These levels are a matter of concern only for persons working close to the fire.

Over 25 hydrocarbons have been detected by current research. Pyrometric Hydrocarbons (PAH) have been known for decades as a potential health hazard. Many PAH have been shown to have carcinogenic potential. A large number of PAH have been identified in combustion products, only a few have been measured in fires, in a limited set of conditions. It has been shown that the average local residence has a greater level of PAH exposure from a wood stove, than from an wildland fire. Wildland fires burning under very stable conditions would have a similar effect on public health. A large number of uncontrolled Wildfires burning under stable conditions in the late summer or fall would pose the greatest hazard to human health. Prescribed fires are designed, planned and regulated to avoid impacts and comply with the provisions of the Clean Air Act.

Nitrogen and sulfur oxides are present in minute or undetectable amounts. Temperatures of open fire are generally not hot enough to form nitrogen oxides, and the amounts created are much less than would occur from normal biological activities. The low sulfur content of forest fuels probably accounts for sulfur not being detected in smoke.

In smoke management, the term "class standards" is used to describe the rating given to an area. Crater Lake National Park is a Class One area, which means that only small smoke intrusions are allowed. Gearhart Mtn. Wilderness is also a class one area. The Klamath Falls Special Protection Zone (SPZ) includes all areas within the county where burning is thought to affect the winter metropolitan air quality. Burning within the SPZ is controlled during the winter months. The Oregon Smoke Management Plan includes provisions to protect air quality and visibility within the state of Oregon. All prescribed burning proposed by this action would comply with the Federal Clean Air Act as amended, the Oregon State Implementation Plan (SIP) and the Oregon Smoke Management Plan (OSMP).

Burning with a higher fuel moisture ensures that less emissions occur during each burn. There is a 4% reduction in particulates for every 1% increase in fuel moisture for fuels over 3" in diameter. Transport winds would be selected to avoid Class One visibility areas and the SPZ.

The Affected Environment, Environmental Consequences section and Appendices from the FSEIS, discusses Air Quality in further detail (volume 1, pages 83-103).

Air quality protection to ensure human health and avoidance of visibility degradation are best achieved from planned fire (Alternative A and D) where emissions can be controlled. Alternatives B and C provide little control of timing or amount of emissions.

Fire Effects on Historic and Cultural Resources

There are two levels of cultural resources requiring protection under the various laws of the United States. They are the archaeological/historical which are tangible, and the cultural which in many cases are intangible. These include the various religious and cultural practices of the people who were indigenous to the area at time of contact by Euroamericans, and who remained in place well into the 19th century.

Alteration of the earth surface, and increasing human activity in a given area pose immediate threats to both surface and subsurface historical and archaeological cultural resource sites. Obviously, structural remains are severely impacted by fire, both natural and human caused. In addition, fiber, wooden and other combustible artifacts are severely impacted by fire. Subsurface archaeological remains are often impacted by fire fighting and control techniques such as hand lines and dozer lines which disturb the earth. Often, middens contain fiber materials which will burn when the midden is impacted by fire. In contrast, plant resources often benefit from fire with increased production.

In all cases of prescribed fire areas, there will be an expanded, BLM Class I or Class III survey of the area to be burned prior to ignition. This survey will omit exceptionally steep slopes (over 30%), and other low site probability areas. The survey, on an intuitive complete basis, and will closely inspect all high probability areas such as rock outcroppings, ridges, stream banks, wet areas including springs, seeps, and their associated land forms. Total avoidance procedures will be used in any area where the fire would impact known archaeological/historical remains. In areas where there is an exceptionally high probability of human activity sites such as riverine areas, intensive survey methods will be used. Often the end result is avoidance of the suspect area. A cultural resource technician will monitor all earth disturbing activities to avoid disturbance of subsurface deposits of cultural material. If cultural materials are revealed in areas where the earth has been disturbed, immediate steps will be taken to put avoidance procedures into effect.

Whenever possible, plant areas historically used by Native American people will be noted, and mapped. If there are indications fire would be harmful to regeneration of the plant resource, avoidance procedures will be instituted.

As a rule, the impact of fire on archaeological sites is minimal. Historic sites that might be impacted by fire are best protected by burning vegetation around the site to protect it from unplanned fire events. Some fire suppression activities such as dozer fire trails have far greater impacts than a method that is less disturbing. Pre-planned hand lines, (Alternative C does not allow for this), where a cultural survey has been completed, is a good less disturbing example. All sites are best protected by design and implementation (Alternatives A, B, D) that occurs prior to the unplanned event.

Fire Effects on Recreation and Visual Resources

The preferred alternative, MI prescribed burning, could have short term negative effects to recreationists. The greatest chance for negative effects would be in areas of concentrated recreation use, such as developed recreation sites or the upper Klamath River Canyon. Recreationists could be negatively effected due to the effects of smoke during prescribed burning in the spring and fall. However, the highest recreation use occurs during the summer months, when the likelihood of wildfire is the greatest. Therefore, the highest potential for negative effects to recreationists would be during the summer months. High use recreation areas are often closed for wildfire fighting and thick smoke from wildfires is not conducive to recreating.

Recreationists can also be negatively effected by the changes in the visual resource or landscape from prescribed fire, wildfire and mechanical treatment of fuels. Catastrophic wildfires can produce the greatest long term negative change to the landscape, and can decrease recreation use in an area due to these unsightly changes (large areas of blackened ground, stumps and standing burned trees and unplanned tractor lines). Mechanical treatment can also produce low to moderate negative visual effects, however, mitigation can be implemented to reduce these effects in visually sensitive areas. Also, these effects are usually of less impact and of a shorter time duration than wildfire. Prescribed fire can also produce low to moderate negative visual effects but can also receive mitigation to lessen impacts in sensitive areas.

Based on the prescribed fires conducted by the Klamath Falls Resource Area over the past decade, these negative visual effects are generally described as a mosaic of burned and unburned ground, stumps and boles of trees and occasional small trees that are consumed. Areas receiving prescribed fire are not readily apparent to the casual observer, however. The most impacted areas are usually quite small, one quarter (1/4) acre or less, where clumps of trees are consumed, for example. Recovery time is fairly rapid. Within a one (1) year any blackened ground is covered by needle fall, leaving a mosaic of scattered burned and unburned stumps, snags and trees. This mosaic of burned and unburned areas is probably more typical of true historic natural landscapes, created from more frequent fires, than present existing landscapes. In general, existing landscapes frequently exhibit little obvious evidence of recent fire, other than occasional areas where catastrophic wildfires have caused large scale negative effects to the landscape, through high intensity, stand replacing type fires.

Fire Effects on Economic Resources

Product gain or loss

Prescribed burning can potentially increase the quality and quantity of forage plants preferred by livestock, especially grasses. Often a short term (3 years or less) loss of forage is more than compensated for by a long term increase in desirable grasses and forbs. Forage is also improved by reducing the density and competition from less desirable (as forage) shrubs and trees. Grass production is also increased by reducing the depth and extent of cover of duff layers.

An extensive amount of prescribed burning occurring in a given year within an individual allotment could result negatively in a short term decrease in livestock grazing capacity. This loss would be compensated in the longer term with increased forage quantity and quality.

Several studies have pointed to the fact that a timber stand growing in a short return fire area where fire has been excluded cannot reach maturity without fire visiting the stand. It is better to have a small loss of growth and limited individual tree mortality from prescribed fire as compared to a major loss from wildfire as total stand mortality. In the past, fire salvage was normally considered a fair return after a wildfire occurrence. New priorities and direction have made salvage of fire killed timber a less certain post wildfire event.

Risk from actions

The primary risk associated with management ignited fires **(Alternative A)** is the risk of an escaped fire. A prescribed fire becomes a wildfire when it moves out of the designated prescribed fire area onto other public or possibly private lands. The effects of an escaped fire may be similar to the prescribed fire, or due to increased fire intensity, may be more severe. The exact effects will depend on site specific fuel and weather conditions. Additional adverse effects may occur due to suppression efforts. All escaped fires are suppressed as quickly as possible.

A secondary risk from prescribed fire is that unexpected negative effects may occur on any given prescribed fire site. Due to unanticipated increases in fire intensities, there could be adverse affects on some resources. These types of effects are usually limited to relatively small areas.

The risk of severe resource damage due to wildfires is decreased under this alternative. Wildfires occurring in treated areas are easier to contain, thus burning fewer acres. Wildfires burning in treated areas will have a lower intensity, causing less resource damage. Risk to the health of the ecosystem would reduce over time as components (composition, structure, function) of the ecosystem are brought within natural ranges of variability.

The Prescribed Natural Fire (Alternative B) option has the same type of risks associated with alternative A above. The risk of an escaped fire will be lower as few prescribed natural fires would occur as compared to management ignited fire.

Under this alternative the risk of severe damage to resources from wildfire increases. This risk will likely increase over time, as the amount of area treated under a strict prescribed natural fire program would be offset or exceeded by the accumulation of natural and activity fuels. Risk to ecosystem health would similarly increase over time, but not as rapidly as in Alternative C.

The No Action Alternative (Alternative C) is in reality a decision to allow wildfires to occur in what are no longer natural ecosystems. There is no risk from any activity associated with prescribed fire. The risk of severe damage from wildfires and associated suppression actions continues and increases over time. Wildfires will continue to occur. Suppression actions will continue under existing guidance. Those fires occurring under the worst burning conditions will exceed suppression efforts and cause severe resource damage. Risk to ecosystem health would increase over time as ecosystem components stray further from their natural ranges of variability.

Under Alternative D, risk of severe damage to resources due to wildfire is similar to Alternative B. The risk of an escaped fire would be very low. Some damage to soil and hydrologic resource would be a certainty. The risk to ecosystem health in the long term may be high because the "unnatural" nature of this action may cause some ecosystem components to stray very far from their natural range of variability.

Savings versus expenditures

The cost of past prescribed burns (restoration burns) in the Klamath Falls Resource Area has averaged $40-50 per acre. This cost will increase gradually in the future and substantial increases will occur when dealing with isolated parcels or more complex fuel types. Maintenance type burns are expected to cost about one half that of restoration burns. While some damage to resources may occur as a result of prescribed burning, past damages have not been substantial enough to warrant an estimate of an actual dollar amount.

The cost of suppressing wildfires is tracked and grouped by the size of the fire. The cost of suppressing small fires, less than one acre in size, is about $2,300 per fire. The actual suppression cost for larger fires occurring in the Klamath Falls Resource Area in 1992 ran from $1,800 to $3,000 per acre.

Resource damages from wildfires are difficult to quantify. While it is possible to place actual dollar value on some areas such as timber, forage, and rehabilitation costs; damages to other resources such as wildlife, watershed and soils are almost impossible to quantify. Recent increases in timber prices have substantially increased the quantifiable portion of resource damages from wildfire. The value of timber lost recently to wildfire within the Klamath Falls Resource Area has equaled or exceeded the suppression cost. When damages (quantifiable or not) to other resources are added the total cost of wildfires far exceeds the cost of several prescribed fires.

Table 4. Summary of the Severity of Overall Effects (on all resources) comparing the Proposed Action and Other Alternatives.

	Alternative			
Resource	**A**	**B**	**C**	**D**
Plants	L	L	M	H
Animals	L	M	H	H
Soil	L	M	M	H
Water Quality	L	L	M	H
RMAs	L	M	H	H
Air Quality	M	H	H	L
Histroic (cultural)	L	L	H	M
Recreation	L	H	H	M
RIA	L	M	H	L

The following items would not be affected by this action:
Areas of critical environmental concern, floodplains, wilderness values, paleontological resources, prime or unique farm lands, lands, minerals, wildhorses.

L = Low Severity; M = Moderate Severity; H = High Severity

Monitoring

Items to monitor: (informal review on a yearly basis, formal review on a decadal basis)

* Percentage of overstory cover and composition made up by individuals in senessece.
* Percentage of area meeting the "Old Growth Definition" prepared by the U.S. Forest Service. This defines the typical range (number) of snags, down logs and trees within size (diameter) classes.
* Changes in fuel models and fuel parameters that constitute the fuel models.
* Evaluate the effectiveness of prophylactic measures on the health and well being of relic and special specimens.
* Evaluate impact of burning on special status species and situations where "takes" did occur. Note the effects of fire on non-sustainable habitat
* Evaluate the savings of resources and funding allocations that occurred as a result of prescribed burning versus wildfire.
* Discuss new knowledge in fire effects that has been acquired because of the burning experience.
* Note changes in plant communities and determine the causes.
* Note changes in species of fauna and habitat, determine the causes.

Agencies and Individuals Contacted

A complete list of individuals, organizations, and state and federal agencies that were contacted during the scoping process is available at the Klamath Falls Resource Area office or upon request from Joe Foran at (503) 883-6916. This list contains 250+ entries.

REFERENCES & SUGGESTED READING

There are thousands of scientific studies and historical accounts on the effects of fire. Some of the more important and interesting documents available are listed below. This EA also contains much unpublished information obtained through interviews with researchers, reports of management task forces or collective individual experience. In references authored by more than one individual, only the first is listed.

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Attachment 1. KFRA Specific Prescribed Fire Data Sheet

Fire Management Unit # ________________________ T. _______S., R. _______ E., Sec. _______

FMU Acres: _______ SPZ Y( ) N ( ) Unit Name: ______________________________________

Plant Association: ________________________ Source: ___________________________________

Watershed Unit Analysis: ____

IDT Date: ______________________ USGS Quad. Map: ________________________________

Prescribed Fire Resource Objectives: ____

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Cultural Survey Date: ________________ Signature: ______________________________________

Remark: ____

____
____
____

Botanical Survey Date: ________________ Signature: ____

Remark: ____

Section 7 Consultation: Formal ( ) Informal ( )

Biological Evaluation Date: ________________ Signature: _________________________________

Biological Assessment Date: ________________ Signature: _________________________________

Remark: ____

USFW Review Concurrence Date: _____________ Name: _____________________________________

Remark: ____

____

____

Public Comment Period: Start Date: __________ End Date: __________

IDT ( )

Project Mitigation:

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Fire Management Unit: __________________________ FMS

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Prescribed Fire Intensity: Low ( ) Medium ( ) High ( ) Fuel Model(s) ____________

Percent of Normal Model Load: _____% T/A Slope: _____%

Fuel Depth: _____" Duff Depth: ______" Duff Load: _____" T/A Aspect: _____"

1000 Hour Load: __________ (3-9") T/A Basal Area: ____________ sq/ac

Canopy Closure: _____% 10,000 Hour Load: ___________ (>9") KPI #

____

Forest Type:

____

______

Date of Last-Fire Occurrence: _______________ Elevation: _______________

Burn Plan ( ) / / Exposure to Wind:

Special Considerations:

____

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Environmental Assessment Compliance Review:

Monitoring Results:

Time Lag		Diameter of Materials	Litter Depth
1 hour	*	Up to 1/4 inch	Up to 1/4 inch
10 hour	*	1/4 to 1 inch	1/4 to 1 inch
100 hour	*	1 to 3 inches	1 to 4 inches
1000 hour		3 to 9 inches	4 to 12 inches
10000 hour		9+ inches	

* 1-, 10-, and 100-hour surface fuels included in fuel model parameters.

Litter Calculations: $\text{Litter Weight} = \frac{3630 \times 5 \text{ lbs./cu. ft.} \times \text{depth (inch)}}{2000}$

Duff Calculations: $\text{Duff Weight} = \frac{3630 \times 10 \text{ lbs. or } 12.1 \text{ lbs.} \times \text{depth (inch)}}{2000}$

10 lbs./cu.ft. is used for long needle conifers

12.1 lbs./cu.ft. is used for short needle conifers

Attachment 2. Wildfire and Prescribd Fire.

A. Prevention

Objective: To minimize occurrence of severe intensity wildfires in riparian management areas (RMAs), on erosion-susceptible soils, and in high risk watersheds.

Practice: Utilize prescribed burning to reduce both natural and activity slash (fuel) adjacent to and/or within these areas.

Design fuel treatment and fire suppression strategies that recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management activities could be damaging to long-term ecosystem function.

B. Suppression

Objective: To minimize water quality degradation while achieving rapid and safe suppression of a wildfire.

Practices: Use the soil and water resources impact evaluation worksheets during emergency fire situation analysis to determine appropriate suppression methods.

Apply intensive and conditional suppression in high-risk watersheds and conditional suppression in RMAs.

Locate incident bases, camps, helibases, staging areas, helispots, and other centers for incident activities outside of RMAs. If the only suitable location for such activities is within an RMA, an exemption may be given following a review and recommendation by a resource advisor. The advisor will prescribe the location, use conditions, and rehabilitation requirements. Utilize an interdisciplinary team to predetermine suitable incident base and helibase locations.

Exclude tractors within RMAs. Limit use of heavy equipment near RMAs, on slopes grater than 35 percent, and in high-risk watersheds. Where fire trail entry into a RMA is essential, angle the approach rather than have it perpendicular to the RMA.

Avoid dropping fire retardant into any flowing stream or water body. Apply aerial retardant adjacent to RMAs by making passes parallel to RMAs.

C. Rehabilitation

Objective: To protect water quality and soil productivity with consideration for other resources.

Practices: Utilize information from burned area surveys to determine if watershed emergency fire rehabilitation plan through an interdisciplinary process. Whenever RMAs are significantly damaged by a wildfire or a prescribed fire burning out of prescription, develop a rehabilitation treatment plan to meet Aquatic Conservation Strategy Objectives.

Select treatments on the basis of on-site values, downstream values, soil erosion potential, probability of successful implementation, social environmental considerations (including protection of native plant communities), and cost as compared to benefits.

Examples of emergency fire rehabilitation treatments are listed below. Other examples are listed in Section XIX of the Klamath Falls Resource Area Interim Watershed Management Practices Guide.

Seed grasses or other vegetation as needed to provide a protective cover as quickly as possible, using native species whenever practicable;

Mulch with weed free straw or other suitable material;

Fertilize;

Place channel stabilization structures;

Construct waterbars on firelines;

Log erosion barriers (contour-felled and anchored trees).

D. Prescribed Fire

1. General Guidelines

Objective: To maintain long-term site productivity of soil.

Practice: Evaluate the need for burning based on soils, plant community, hazard reduction objectives, site ecology and site preparation criteria Burn under conditions when a light to moderate-intensity burn can be achieved (see guidelines below) except when exosystem management objectives dictate achievement of a burn of higher intensity.

Conditions outlined in Section IV will be met.

Guidelines for Levels of Burn Intensity

	Proportional Area	**Visual Charactterization**	**Site-Specific Results**
or other partly burned, charred.	Less than 2 percent is severely burned. Less than 15 percent is moderately burned.	Light Burn	Duff, crumbled wood woody debris is logs not deeply
other partially to mostly be deeply soil under the changed in	Less than 10 percent is severely burned. More than 15 percent is moderately burned.	Moderate burn	Duff, rotten wood, or woody debris consumed; logs may charred but mineral ash not apprecialbly color.
soil signif- color, usually half inch organic matter conducted	More than 10 percent is severely burned. More than 80 percent is moderately burned. Remainder is lightly burned.	Severe burn	Top layer of mineral icantly changed in to reddish color; next blackened from charring by heat through top layer.

2. RMAs

Objective: To maintain a healthy riparian zone and water quality by minimizing erosion levels within RMAs.

Practices: Hand piling and burning will be the preferred fuel treatment within 100 feet of RMAs. Design prescribed fire projects to contribute to the attainment of Aquatic Conservation Strategy objectives and to minimize disturbance of riparian ground cover and vegetation.

When an RMA is within a burn unit and conditions warrant, only low intensity fire will be prescribed within 100 feet of RMAs. No intentional ignition will occur within 50 feet of RMAs except where watershed, wildlife habitat or riparian-wetland enhancement is the objective. Fires will be allowed to "back into" RMAs as long as a primarily light intensity burn is maintained.

3. Firelines

Objective: To minimize soil disturbance, soil compaction, soil erosion, and disturbance to RMAs.

Practices: Construct firelines by hand on all slopes greater than 35 percent.

Utilize one-pass construction with a brush blade or one edge of a tractor blade to construct tractor firelines, or construct firelines by hand.

Construct waterbars on tractor and hand firelines according to guidelines in Section VII.E.3.

No machine constructed firelines in RMAs.