FINAL ENVIRONMENTAL ASSESSMENT

Bald Eagle Habitat Improvement Project
(Descriptive Title for Proposed Action)

Klamath Basin National Wildlife Refuge Complex
(FWS Unit Proposing Action)

Refuge Administration Act
(Legal Mandate Under Which Action Will be Carried Out)

Bear Valley National Wildlife Refuge
(Location of Action)

Jim Kelton

Ed Arnett
(Authors of Document)

6-13-96
(Date Prepared)

FINAL ENVIRONMENTAL ASSESSMENT

for the

BEAR VALLEY NATIONAL WILDLIFE REFUGE

BALD EAGLE HABITAT IMPROVEMENT PROJECT

Klamath Basin NWR Complex

USDI Fish and Wildlife Service

Klamath County, Oregon

Responsible Official: Tom Stewart
Refuge Manager
Klamath Basin NWR's
Route 1, Box 74
Tulelake, CA 96134
(916) 667-2231

ABSTRACT

The U.S. Fish and Wildlife Service proposes to implement a plan for long-term maintenance and improvement of bald eagle (Haliaeetus leucocephalus) roosting habitat at the Bear Valley National Wildlife Refuge in southcentral Oregon. This refuge was created to protect timber stands used by large numbers of eagles for winter roosting. However, past high-grade logging activities coupled with exclusion of natural fire cycles have yielded excessive fuel loadings and overstocked stand densities, thus placing roosting habitat at risk to catastrophic wildfire and potential forest health problems. If action is not taken to reverse current trends, eagle roost habitat could be lost disease and wildfire.

Six alternatives were developed during the planning and scoping process. Maintaining preferred eagle roosting habitat, improving forest health, and reducing wildfire risk were major issues considered during the development of the alternatives. ALTERNATIVE 1 is the "No Action" alternative. ALTERNATIVE 2 would utilize prescribed fire alone for maintaining eagle roost habitat. ALTERNATIVES 3, 4, and 5 propose the use of silvicultural treatments and prescribed fire for long-term maintenance of eagle roosting habitat. ALTERNATIVE 6 proposes a rigorous experimental design to evaluate eagle response to silvicultural manipulation of roost habitat.

Alternative 3 has been identified as the preferred alternative. It would utilize five commercial timber sales over a ten to fifteen year period to thin the present timber stands to a desired stocking

density. Two silvicultural prescriptions specifically formulated to reduce the risk of catastrophic wildfire and potential forest health problems at Bear Valley NWR would be tested in the first treatment. An adaptive management approach will be used to examine the results of the first thinning and improve future silvicultural treatments based on this experience. After initial thinning, prescribed fire would be used in treated stands to maintain fuel loading at an acceptable level and move the tree species composition toward a more natural condition (ie. more fire tolerant tree species). Habitat improvement activities would tentatively begin in the summer of 1996.

Details of this Environmental Assessment may be reviewed at the Klamath Basin NWR Complex Headquarters in Tulelake, California. For more information, contact Dave Mauser at: Klamath Basin NWR's, Route 1 - Box 74, Tulelake, CA 96134, (916) 667-2231.

FINAL BEAR VALLEY ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

BEAR VALLEY
FINAL ENVIRONMENTAL
ASSESSMENT

CHAPTER 1

PURPOSE AND NEED FOR ACTION

The U.S. Fish and Wildlife Service (USFWS) proposes to implement a plan for long-term maintenance and improvement of bald eagle (Haliaeetus leucocephalus) roosting habitat at the Bear Valley National Wildlife Refuge in southcentral Oregon. The preferred alternative identified below would utilize five commercial timber sales over a ten to fifteen year period using one of two silvicultural prescriptions specifically formulated to maintain present eagle roosting and nesting habitat, maintain forest fuels at an acceptable level, and reduce the stocking density trees to match the areas carrying capacity. The first area to be thinned will test two silvicultural prescriptions with slightly different objectives. Subsequent habitat improvement activities will use the prescription determined to be the best by an Interdisciplinary Team (IDT) of biologists and foresters. The adaptive management approach to be used specifies activities for the first two years of the project; later actions will build on and improve on previous experience at the Refuge. After initial thinning, prescribed fire would be used in the treated stands to maintain forest fuels at a low level and move the stand composition toward a more natural fire tolerant species composition. Habitat Improvement activities would tentatively begin in the summer of 1996.

A. PROJECT AREA LOCATION

The Bear Valley National Wildlife Refuge (NWR) is one of 6 refuges which comprise the Klamath Basin NWR Complex in southcentral Oregon and north central California. Bear Valley is located approximately 13 miles southwest of Klamath Falls, Oregon and 2 miles west of Worden, Oregon (Figure 1). It is administered by the Klamath/Central Pacific Coast Ecoregion of the USFWS.

The Refuge was established to preserve an important winter communal roost area for bald eagles in the Klamath Basin. In some years over 1000 bald eagles have wintered in the Klamath Basin, constituting one of the largest concentrations in the lower 48 states. As many as 64% of the entire wintering population in the Basin utilizes the roost at Bear Valley between mid-October and April. The importance of the Bear Valley roost for wintering bald eagles in the Klamath Basin has been well documented (Opp 1980, Keister 1981, Anthony et al. 1982, Keister and Anthony 1983, DellaSala et al. 1987, Keister et al. 1987).

Prior to acquisitions by the USFWS, 12 different ownerships existed in the Bear Valley area, including Boise Cascade, the State of Oregon,

Weyerhaeuser Company, and several individual private landowners. Acquisitions began in 1978, and the present Refuge encompasses nearly 4,200 acres.

Four distinct core roosting areas have been documented at Bear Valley NWR (Figure 1) (DellaSala et al. 1987). These will be referred to in this document as "core roosts" or as "subroosts". The Bear Valley NWR as a whole will be referred to as the "roost".

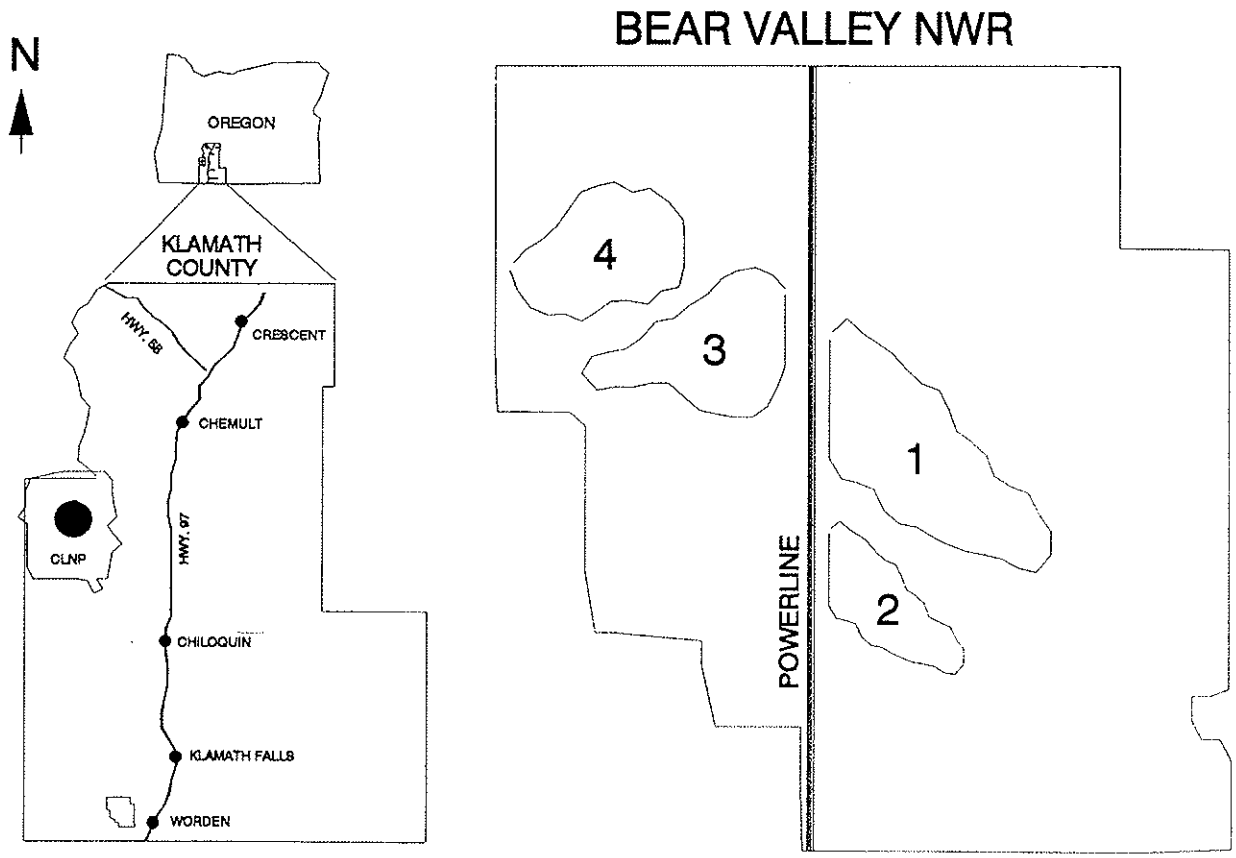


Figure 1. Location of the Bear Valley National Wildlife Refuge (NWR) in Klamath County, Oregon, and general location of 4 subroosts within the Refuge.

B. NEED FOR ACTION

As a result of the existing condition of forest stands at Bear Valley, long-term perpetuation of preferred roosting habitat for bald eagles appears to be in jeopardy. Each subroost at the Refuge is progressing toward a climax mixed-conifer forest dominated by white fir, thus deteriorating eagle roosting habitat and contributing to declining forest health and disease (DellaSala et al. 1987). This alteration of the current habitat features through succession, coupled with a high lightning strike frequency, could result in catastrophic wildfire at Bear Valley NWR. If habitat improvement actions are not undertaken, the trees that eagles use for roosting may be lost.

C. CURRENT CONDITION

The condition of the mixed conifer and ponderosa pine (Pinus ponderosa) stands at Bear Valley NWR are similar to those described in other areas of the Klamath Basin and forests east of the Cascades. Tree mortality appears to be lower at Bear Valley compared to other areas, however, likely because of aspect/elevation/precipitation relationships which result in more moderate moisture conditions at the Refuge.

Bear Valley has been ecologically classified as being in the Ponderosa Shrub Forest section of the Intermountain Sagebrush Province (Bailey, 1980). In this region, fire and/or its exclusion has shaped many of the vegetation communities and patterns of species composition (DellaSala et al. 1987). Data indicate a natural, long-term fire frequency of 30 to 50 years in climax ponderosa pine communities in this region (Franklin and Dyrness 1973, Weyerhaeuser 1992). Ponderosa pine-white fir (Abies concolor) forests in Crater Lake National Park have a mean fire interval of 9 to 42 years (McNeil 1987), while fires in Douglas-fir (Pseudotsuga menziesii) stands on dry sites in Oregon average 100 years (Means 1982) (from DellaSala et al. 1987).

Fire control promotes natural regeneration, overstocking, and associated problems with insects and disease (Emmingham et al. 1992). Fire suppression in the Bear Valley region has generally converted many stands from fire-resistant, open-grown ponderosa pine to relatively dense stands of fire-intolerant white fir, Douglas-fir, and incense cedar (Calocedrus decurrens). Past harvest methods, including selective high-grading of ponderosa pine, have also changed successional patterns of forests in this region (Emmingham et al. 1992).

DellaSala et al. (1987) found relatively high densities of white fir throughout the core roost areas, particularly at higher elevations in subroosts 3 and 4 (Tables 1 and 2). White fir is a problem for two reasons. It develops poor roost-tree characteristics because it has relatively fine branches and dense tree crowns and is therefore less desirable to eagles. White fir encroachment also appears to preclude regeneration of more desirable roost tree species.

Table 1. Mean basal area, stem density, and diameter breast height (DBH) for subroosts 1-4 at Bear Valley National Wildlife Refuge, Oregon (modified from Dellasala et al. 1987).

	ROOST NUMBER			
	1 (n=40)	2 (n=14)	3 (n=30)	4 (n=47)
		Douglas-fir		
Basal Area (ft^2/acre)	56.00	52.49	36.38	25.00
Stems/acre	159.82	112.49	104.18	52.14
DBH (inches)	8.41	8.91	7.35	9.07
		Ponderosa Pine		
Basal Area (ft^2/acre)	30.45	15.20	27.71	28.66
Stems/acre	83.50	52.66	66.24	100.96
DBH (inches)	7.87	6.54	8.42	8.12
		White Fir		
Basal Area (ft^2/acre)	15.16	8.19	25.66	60.25
Stems/acre	56.68	36.73	100.13	193.13
DBH (inches)	6.17	5.06	6.19	6.22
		Incense Cedar		
Basal Area (ft^2/acre)	12.42	11.37	2.44	3.01
Stems/acre	50.91	64.49	13.77	5.86
DBH (inches)	5.83	5.93	3.75	5.01
		Sugar Pine		
Basal Area (ft^2/acre)	0	0	3.75	2.53
Stems/acre	0	0	8.64	5.94
DBH (inches)	0	0	9.11	6.96
		Western Juniper		
Basal Area (ft^2/acre)	0.13	0.26	0.17	0
Stems/acre	1.01	1.16	1.62	0
DBH (inches)	4.32	6.10	3.76	0
		All Tree Species Combined		
Basal Area (ft^2/acre)	114.13	87.52	99.10	119.49
Stems/acre	351.92	267.49	294.33	358.00
DBH (inches)	7.87	6.54	8.42	8.12
Snags/acre (> 40 ft. tall)	1.52	2.60	1.33	3.63

Table 2. Mean seedling (< 3 ft. tall) and sapling densities of white fir and Douglas-fir for subroosts 1-4 at Bear Valley National Wildlife Refuge, Oregon (modified from Dellasala et al. 1987).

	ROOST NUMBER			
	1 (n=40)	2 (n=14)	3 (n=30)	4 (n=47)
Seedlings (stems/acre)				
White Fir	9.72	28.92	55.87	93.55
Douglas-Fir	13.36	12.72	63.70	103.02
Saplings (stems/acre)				
White Fir	19.84	12.72	63.70	103.02
Douglas-Fir	53.44	30.01	39.41	12.58

It is well documented that overstocked stands yield trees which are stressed and in poor health because of increased competition for resources, particularly in drought years. Such conditions can increase tree susceptibility to disease and insect attack (McCambridge and Stevens 1982, Fiddler et al. 1989, Patterson 1992). The presence of various root diseases, decay fungi, dwarf mistletoe, and insects (e.g. pine beetles, fir engravers) is evident at Bear Valley (H. Maffei, U.S. Forest Service, pers. commun.). Poor forest health in the Klamath Basin has been exacerbated by prolonged drought-like conditions over the past several years (Figure 2). Barrett et al. (1983) suggested that ponderosa pine is able to withstand annual dry periods in summer and periodic droughts, but becomes much more susceptible to disease and insect attack during these periods.

Overstocking in many stands, particularly with white fir saplings, coupled with excessive dead and down material has rendered the Bear Valley roost highly susceptible to catastrophic wildfire. Since 1982, 1 human- and 4 lightning-caused fires have occurred on the Refuge, and 17 others occurred within a 2 mile radius of the Refuge boundary. During the past 14 years, 78 human- and lightning-caused fires have occurred on or within 5 miles of the Refuge (M. Dykzeul, Weyerhaeuser Company, unpubl. data). Lightning maps for the past ten years show that the Bear Valley NWR and the surrounding area are struck by lightning numerous times each summer. (S. Stillings, BLM, National Interagency Fire Center, unpubl. data)

Prescribed fire has been used at Bear Valley NWR in the past in an attempt to alleviate forest health and wildfire problems. In the late 1980s the Winema National Forest was contracted to do prescribed burning in an attempt to restore the fire regime to the forest. In areas where the burns were limited to the understory, some areas (particularly in the lower elevation ponderosa pine forests) show good results while other areas show extensive tree mortality and increased fuel loading due to accumulation of dead limbs on the ground. However, the blocks that were burned have not been extensive enough to affect overall forest health or fuel continuity. Several of the burns reached the canopy, killing all trees involved. One of these crown fires totally blackened about eight acres on the north side of subroost 1 in 1990. After this fire escape the USFWS decided that the use of prescribed fire alone without prior fuels treatment was too risky and ceased prescribed burning until the fuel loading problem was addressed.

D. DESIRED FUTURE CONDITION

Bald eagles generally prefer older, taller, and larger diameter trees for nesting (Andrew and Mosher 1982, Anthony et al. 1982, Jensen 1988, Anthony and Isaacs 1989, Wood et al. 1989) and roosting (Keister 1981, Keister and Anthony 1983, DellaSala et al. 1987, Isaacs and Anthony 1987, Anderson and Patterson 1988). In the Pacific Northwest, heterogeneous, multi-layered stands of mature or old-growth coniferous forest with numerous spike-top trees and snags are preferred nesting and roosting sites (Keister and Anthony 1983, Stalmaster et al. 1985).

Precipitation history, Klamath Falls, Oregon, from 1884 to 1992.

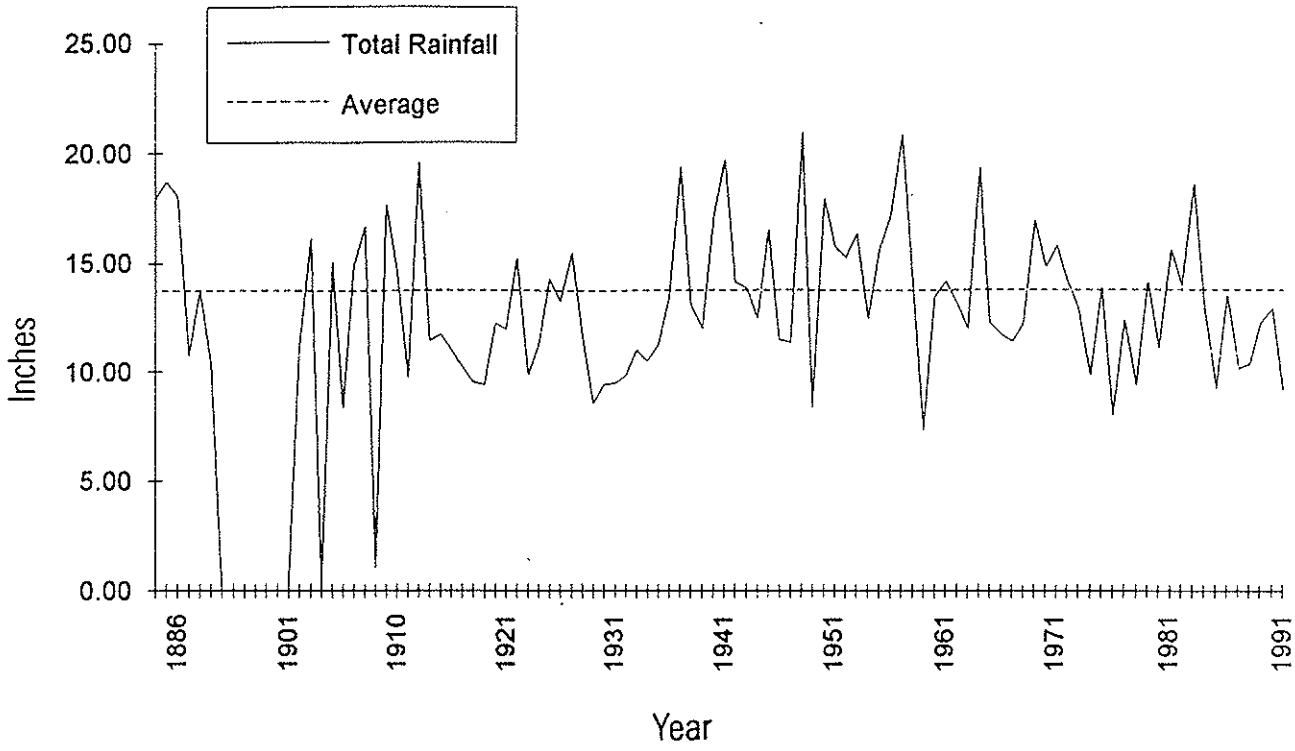


Figure 2. Precipitation levels in Klamath Falls, Oregon, from 1884 to 1992 (from Weyerhaeuser 1992).

In Bear Valley, large Ponderosa pine and Douglas-fir are preferred as roost trees because of the openness of their crowns and larger limb size.(DellaSala et al. 1987). Roost and nest trees are generally dominant or co-dominant in the canopy (that is, they are the tallest or among the tallest trees in the timber stand) and typically have more diffuse crowns and a greater number of exposed branches relative to other trees in a stand.

The Bear Valley NWR was created to protect this type of eagle roosting habitat. If it is lost, such habitat could not be replaced for hundreds of years. Therefore, the goals of bald eagle habitat improvement activities in the Bear Valley Refuge are to:

1. Maintain the health and vigor of existing eagle roost trees.
2. Create stand conditions that will provide for additional bald eagle roosting habitat needs in the future.

Specific project objectives to achieve these goals include:

A. Reduce the potential for forest health problems by reducing stocking densities to those which are sustainable for the site.
B. Increase growth and regeneration potential of desired roost tree species (ponderosa pine and Douglas-fir).
C. Decrease fuel loadings in each subroost to reduce the probability of catastrophic wildfire.
D. Maintain snags as a roost stand component.
E. Monitor response of trees and vegetation to determine whether management actions are effective.
F. Monitor eagle response to habitat treatments to evaluate their relationship with forest management.

Initial habitat improvement should curb the potential for major tree loss to large outbreaks of disease and insects in the future. However, once initial treatments improve overall forest health, some natural mortality would be acceptable in areas of the Bear Valley roost. Disease and insects are a primary source of discontinuities in stand structure and are important natural sources of landscape diversity (Lundquist 1993). DellaSala et al. (1987) suggested that small insect and disease outbreaks may enhance eagle roosting habitat at Bear Valley through creation of snags and exposing understories to increased light levels. Marsden et al. (1993) warned that failure to consider forest diseases in the forest management planning process would likely result in a failure to obtain the desired future condition.

Although Bear Valley NWR contains three known active bald eagle nests, the Refuge's most important use is as a communal roost for wintering bald eagles. This project's major focus is to ensure the perpetuation of roosting habitat for these birds.

E. SCOPING

The scoping process for Bear Valley began in October 1992, with

informal discussions among biologists and forestry specialists from the USFWS, U.S. Forest Service (USFS), Oregon Department of Fish and Wildlife (ODFW), and private industry. Prior to preparing a scoping document, the Interdisciplinary Team members met with biologists and researchers from ODFW, Oregon State University (OSU), and private industry to discuss the project in more detail. A scoping document (Arnett 1993) was prepared and distributed to over 50 recipients in April 1993.

Resource specialists from the BLM, ODFW, OSU, private industry, USFWS, and the USFS were consulted during the planning and analysis of this project. A complete list of participants and those contacted appears in Chapter 5.

A draft Environmental Assessment (EA) was circulated in November and December, 1995, as a proposed action to solicit comments. This final EA has been rewritten to incorporate additional comments and suggestions received during the comment period. The public will be notified through advertisements of the proposed action prior to implementation of the selected alternative.

F. ISSUES

The following issues were developed by the IDT, based on field inventory and analysis of the project area, review of available literature, and input from interested parties. These issues, along with the project objectives previously described, were used to develop alternatives.

Silvicultural Treatment Definition

Several alternatives proposed would use a combination of silvicultural and prescribed fire treatments to manage forest species composition and stand structure at the Bear Valley NWR. In this document, the term "Silvicultural treatment" of portions of the Bear Valley Refuge means:

1. Thinning of present timber to a prescribed stand density and size-class prescription by removal of selected trees.
   a. Reducing overall stocking density of all species in various diameter classes.
   b. Increasing growth and regeneration potential of desired roost tree species (ponderosa pine and Douglas-fir) by reducing stocking density of less desirable species, particularly of white fir.
2. Removing disease "pockets" throughout the roost areas.
3. Clearing of road rights of way to maintain fire breaks adjacent to subroosts.
4. Disposal of slash through burning or mechanical means.

The above measures would be accomplished through a commercial timber sale. Another Federal agency, the USDI Bureau of Land Management (BLM), would provide the silvicultural expertise and administer any

timber sales through a cooperative agreement with the USFWS since the USFWS lacks local expertise in this discipline.

The basis for silvicultural treatment is a silvicultural prescription developed from research at Bear Valley conducted by the Oregon Cooperative Wildlife Research Unit at Oregon State University and the USDA Forest Service Forest Sciences Laboratory in Corvallis, OR (Dellasala et al. 1987). This study examined both specific structural features of individual roost trees (e.g. exposed lateral branches, large size) and forest stand composition (e.g. density of tall and large trees) favored by eagles. It then examined the present forest stand composition found at Bear Valley and analyzed these conditions to determine how they could be made more suitable for eagles. The silvicultural prescription detailed in this report was designed specifically to optimize present and future habitat needs of bald eagles in the Bear Valley NWR.

During the comment period on the draft EA, information received on a new analysis of the 1987 study mentioned above indicates that eagles may select roost trees based on both the presence of individual roost trees and relatively high densities of trees with similar characteristics surrounding roost trees (D. Dellasala, World Wildlife Fund, unpubl. data). Based on this input, a second version of that prescription was proposed to develop slightly different forest characteristics.

Environmental Issues:

Forest Health. Long-term health of many timber stands on the Refuge is potentially at risk due to the prevalence of various insects and forest pathogens. Since one of the primary causes of declining forest health is overstocking of timber stands, overall reduction of stand density should improve forest health by reducing stress on individual trees and increasing their resistance to insects and pathogens.

Maintain Existing Bald Eagle Roosting Habitat. Habitat improvement practices must protect the present roosting trees while accomplishing other objectives. No other nearby areas could immediately substitute for the roosting habitat currently found at the Refuge if it is lost. Replacement of the existing roost conditions would take many, many years. No known roost tree should be removed during this project under any circumstances.

Providing for Replacement Roost Trees. The selected project alternative should maintain adequate densities of trees of the proper ages to provide both near- and long-term replacements for the trees currently used by eagles for roosting.

Increase Desired Roost Tree Species/Thin White Fir. Fire suppression and past logging practices have resulted in overstocked forest stands and has allowed for encroachment of white fir at Bear Valley. White fir encroachment has suppressed regeneration of more

desirable roost-tree species, particularly ponderosa pine and Douglas-fir. Promoting growth and vigor of these desired species is a major issue for this project.

Eagle Response. The concern for discontinuation of eagle nesting and roosting because of ineffective habitat management at the Bear Valley roost is shared by all participants of this project. One of these fears is of "putting all our eggs in one basket", that is, treating whole roosts in an ineffective manner and causing the eagles to abandon them. Ideally, only portions of the subroosts will be treated initially. Monitoring of eagle response to treatments will then be conducted to evaluate whether management actions influence eagle roosting before entire subroosts are treated. Modifications to the treatments will take place based on results of monitoring.

Reintroducing Fire. Fire is a major component of ponderosa and mixed-conifer communities in this region but because of the existing condition, prescribed fire by itself could not likely be used to achieve desired stocking densities until fuel loads are reduced. However, fire could be used extensively after stands have been thinned and within previously burned units to maintain desired stocking levels over time. A separate Fire Management Plan for Bear Valley NWR will need to be prepared based on the alternative selected in this EA.

Increased Susceptibility to Wildfire. Habitat improvement at Bear Valley is primarily aimed at reducing the wildfire potential on the Refuge. The existing stand structure at Bear Valley is in jeopardy of loss to catastrophic wildfire because multiple canopy levels provide a continuous ladder of fuels from the ground to the overstory. Extensive dead and down material also has increased fuel loadings in most stands and exacerbates fire risk on the Refuge.

Silvicultural treatment would create another type of fire hazard. The slash created by a timber harvest would need to be treated to reduce the wildfire hazard of dead logging debris.

Socio-economic Issues:

Safety of Fire Suppression Forces. Given the present forest stand structure, a wildfire in the Bear Valley NWR occurring on a hot, dry day is likely to produce high fire intensities and rates of spread. Suppression forces responding to the fire could be at risk due to the poor condition of roads, difficulty of foot travel due to brushy undergrowth, and lack of turn-around areas and safety zones. Any treatment alternative considered as a bald eagle habitat improvement alternative should address the need for improved access and safety areas for fire suppression forces.

Public Safety. The potential exists for a wildfire starting on USFWS land at Bear Valley to spread to adjacent land. If it does,

the resulting fire may become a threat to life and property. Reduced fuel loadings and altered forest stand structure may reduce the risk of a wildfire spreading and improve the ability of suppression forces to control the fire.

Air Quality. Any alternative that relies on prescribed fire as a treatment to manage the eagle habitat will require the management of the smoke produced from the burning. Smoke from prescribed burns in the Bear Valley may create several potential problems:

The Klamath Falls area is a non-attainment area for air quality. At this time, compliance with air quality standards is voluntary but the Klamath Basin NWR fire program strives to comply with air quality requests. Current prescribed burning practices at Tule Lake and Lower Klamath Wildlife Refuges operate successfully within the air quality restrictions.

Smoke could impact several communities and a major highway that lie within a few miles of Bear Valley NWR. Worden, OR, is approximately two miles east of the Refuge boundary. Keno, OR, is approximately three miles north of the Refuge. U.S. Highway 97, which is a major north/south route in central Oregon, passes through Worden and comes within a mile and a half of the Refuge boundary. These three areas all lie in a valley lower than Bear Valley NWR. Therefore, they may be exposed to high smoke concentrations when cool night air settles into the valley. "Smoking in" under nighttime temperature inversions can be an unpleasant and unhealthy nuisance in itself and a public safety hazard as well if concentrations are heavy enough to obscure visibility on roads.

An important consideration in planning prescribed burns is to specify atmospheric conditions under which a burn will take place in order to minimize problems caused by smoke. If prescribed fire is not used then the possibility of natural or human-caused fires increases. Wildfires have the potential to release large amounts of smoke under whatever atmospheric conditions are prevailing at the time. Thus they have the potential to create even greater smoke problems than prescribed fires.

Costs. Certain alternatives will be more costly and take more time to implement than others with essentially the same end result. Sources of funds to carry out the alternatives will differ based on the nature of the action. Alternatives which require appropriated funding will affect the ability of the Refuge and the USFWS to carry out its other programs. Such funds may need to be programmed several years in advance in accordance with the Federal budget cycle. The longer it takes to obtain funding the greater the risk of a wildfire destroying the roosting habitat.

Other alternatives may be carried out by letting a timber sale contract for commercial thinning operations. Any necessary expenses incurred in connection with such a revenue producing

activity would be accomplished through a reduced sale bid. This will make it possible to carry out these alternatives more quickly and with less impact to ongoing USFWS activities.

Costs associated with monitoring eagle response to treatments would not be covered by proceeds of timber sales and funding for such research must be considered separately. Cooperative research agreements may reduce the cost to the USFWS. Weyerhaeuser has expressed an interest in contributing money to participate in a cooperative research project (Ed Arnett, Weyerhaeuser, pers. comm.).

The following issues are recommended to be considered according to USFWS guidance on the National Environmental Policy Act:

Tax Base/Revenue Sharing with the County. If an alternative that involves commercial thinning is selected then a timber sale will be offered for the marketable timber to be removed. Estimates of stumpage value (value of the logs minus the logging costs) of the timber at Bear Valley by the BLM range from $120,000 to $600,000 (Rob McEnroe, BLM, unpubl. data) depending on how large an area is treated.

The USFWS currently pays Klamath County a percentage of Bear Valley NWR's appraised value under 50 CFR Part 34, Refuge Revenue Sharing With Counties. Under this authority the USFWS must pay the county 25 percent of the net receipts from any revenue producing activity, such as the sale of timber, from refuge lands if this amount is greater than the amount currently being paid. Depending on the amount of logging done and the net proceeds per year from the timber sale, the USFWS may be required to pay additional dollars to Klamath County. These additional payments would only be required in the years that 25 percent of the net receipts exceeds the normal payment schedule.

Local Employment. If an alternative is chosen that involves removal of selected tree species then commercial logging operations will be contracted. It is anticipated that such commercial operations will have a positive effect on the local and/or regional economy. There is no guarantee, however, that the timber removed will be processed in the local area or that new jobs would be created.

Other important local economic and employment factors are not directly associated with the Bear Valley Refuge but are related to the eagles use of the area. The presence of eagles in the area draws an unquantified but significant number of tourists to Klamath County. For example, the annual Bald Eagle Conference in Klamath Falls attracts several hundred visitors each winter.

Potentially Controversial Issues:

If the selected action involves a commercial timber sale several

controversial issues may result. Land acquisition for the Bear Valley NWR began in 1978. Some of the land was acquired from landowners who were willing to sell or exchange their land but at least one parcel was acquired through the power of eminent domain from an unwilling seller. The owner of this parcel had planned to log this property. The USFWS filed a declaration of taking on this 240 acre parcel in 1978 to prevent logging of bald eagle roost habitat. Seizing the land to prevent destruction of roost trees only to administer a silvicultural treatment on that same land a few years later gives the appearance of inconsistency. This action needs to be clearly explained as a habitat management practice since it might be misunderstood to be a logging operation.

Allowing timber from Federal lands to be sold and cut is likely to be met with approval from those who wish to see more utilization of Federally-owned natural resources by private enterprise. Such a plan will no doubt be protested by others who may see the USFWS bowing to political pressure to allow logging. The USFWS must adequately demonstrate in this document that a timber sale involving logging techniques would be the most suitable method of enhancing and protecting bald eagle habitat. In this respect it must be noted that the USFWS and the BLM have entered into a Cooperative Agreement that enables the USFWS to receive technical forestry assistance from the BLM. However, the BLM Klamath Falls Resource Area is not being permitted by the BLM Oregon State Office to count any volume of timber that may be produced during thinning operations in Bear Valley NWR toward their yearly output. Therefore, there is no incentive for the BLM to harvest any more timber than what is needed to accomplish the project objectives.

G. ISSUES DROPPED FROM CONSIDERATION

The following issues were raised and considered but were determined to be minor issues. They have been dropped from further consideration in this analysis.

Topography and watershed:

Since existing roads will be used for the most part, no major cuts, fills, or other alterations of the topographical relief will be needed to accomplish any of the alternatives. Minor road improvement, such as grading, brushing, and water-bar construction, will be required under any action alternative. If an alternative involving commercial logging operations is selected, there may be a need to do a small amount of new road construction, depending on the logging system which is used. For example, some roads, which are currently located in drainages, should be relocated to avoid road damage and run-off from erosion if it appears they would be used extensively for logging operations. Relocation of roads from drainages to higher locations would improve the effectiveness of these roads as fire breaks and increase the safety of fire suppression forces as well.

A watershed analysis has not been done on the area, however, there do not appear to be any significant watershed issues such as erosion, runoff, or siltation since there are no perennial streams in the area. Subsurface water is not expected to be affected by any of the proposals. If an alternative involving harvest of timber is selected, then any required watershed protection regulations will be complied with by the agency overseeing the timber sale.

Windthrow:

Tree windthrow or blowdown, especially after mechanical treatments, is a genuine concern in many areas occupied by bald eagles. Field investigations at Bear Valley did not reveal an extensive windthrow problem in this area. Discussions with several local forestry experts corroborate this conclusion. Given the topography, prevailing wind direction at Bear Valley, and anticipated post-treatment stocking densities, extensive windthrow will not likely occur.

Snags:

Snag creation via girdling or blasting was suggested in the scoping document, but will not likely occur during this project because natural snag density appears adequate.

Thermal Characteristics:

Thinning and prescribed burning will undoubtedly alter the microclimate and thermal characteristics within treatment stands at the Refuge. It is uncertain what, if any, effect this will have on eagle use of treated stands. Monitoring, similar to that described by Keister et al. (1985), could be implemented (pending available funding) to determine changes in microclimate conditions and subsequent response by eagles. This issue will be considered under the Eagle Response monitoring issue mentioned above.

Spotted Owl Habitat:

Although Bear Valley NWR is within the range of the northern spotted owl surveys conducted in 1992 and 1993 failed to detect their presence (Weekley 1992 and 1993). Weekley (1992) speculated that the northern spotted owl was not present for the following reasons:

> "To afford protection from avian predators, spotted owls require high over-canopy closure (>70%) (Forsman et al. 1984, Gutierrez et al. 1984). A multi-species, multi-layered understory provides varied roost sites (Barrow 1981, Forsman et al. 1984), yet must be open enough for a large owl to navigate. An accumulation of logs and woody debris are necessary to support a sufficient prey population of small mammals (Spies and Franklin In Press).

Although the habitat within Bear Valley NWR contains some old-growth trees, past management has produced a stand condition and understory which affords little protection from predators and is unsuitable for foraging. Most of the old-growth and mature forest with a canopy cover >70% is at elevations over 5,000 feet. Spotted owls are generally found below 5,000 feet (Thomas et al. 1990). In contrast, where old-growth is present, canopy cover is >70%, and the elevation is below 5,000 feet, the stand structure is even-aged, and the understory is too dense for foraging or navigation by spotted owls.

On a landscape scale, the refuge is surrounded on the north, east, and south by sagebrush and pastureland. To the west lies a checkerboard of BLM, State, and private forests. Management of these forests has generally been heavy selective removal of timber on a 60-80 year rotation. For resident spotted owls, large tracts of land containing significant acreage of old-growth and mature forest are needed for foraging and breeding (Meslow et al. 1981, Rosenberg and Raphael 1986, Meyer et al. 1990, Paton et al. 1990). Although a nesting pair and individual spotted owls have been located in BLM forests 4-5 miles to the west (G. Sitter, BLM, Klamath Falls, OR pers. comm.), the area surrounding Bear Valley NWR is too fragmented and lacks suitable trees necessary to support an extensive local population.

Spotted owls have specific habitat requirements for dispersing juveniles and displaced adults (Gutierrez et al. 1985, Miller 1989). Unfortunately, the fragmented nature or lack of old-growth/mature forestland surrounding the refuge precludes it as suitable dispersal habitat. In addition, the proposed Spotted Owl Habitat Conservation Areas (HCA) (Thomas et al. 1990) are >12 miles from Bear Valley NWR. Twelve miles is the recommended maximum dispersal distance in the Klamath Province (Paton et al. 1990, Thomas et al. 1990). From these proposed HCA's. The closest to Bear Valley NWR is in the Winema National Forest (30 miles northwest), the Siskiyou National Forest, California (30 miles southwest) and the Medford BLM (50 miles west)."

The USFS and the BLM have been given standards and guidelines for the management of land within the range of the northern spotted owl (U.S. Forest Service and U.S. Bureau of Land Management, April, 1994, also known as the President's Forest Plan). The Record of Decision specifically states that the President's plan does not give new management direction to the USFWS. Lands administered by the USFWS are considered "Congressionally Reserved Areas" under this plan and management of these lands follows the direction of the legislation that created them.

Since the Bear Valley NWR was created specifically to preserve the winter roost habitat of bald eagles, activities will focus on maintenance of known eagle roost habitat although specific silvicultural prescriptions for each year's thinning activities will attempt to accommodate the habitat needs of other species

whenever possible (Appendix A - Silvicultural Prescription). If the spotted owl survey scheduled for the spring of 1996 detects the presence of any spotted owls, additional consideration will be given to them when treating the area. The USFWS Endangered Species Division will be consulted to determine additional considerations for spotted owls prior to beginning any action.

The President's Forest Plan guidelines that apply to the USFS and BLM are intended to preserve the elements of late-successional forests, also known as mature and "old growth" forests, while still allowing forest products to be removed for economic purposes. The intent of this bald eagle habitat improvement plan is to begin to return the second-growth timber stands of the Bear Valley NWR to a late-successional condition to benefit species that depend on this type of forest, which may include spotted owls. In this situation, timber production is a byproduct of the action and not one of the goals. This plan is therefore even more restrictive than the guidelines found in the President's Forest Plan.

Even though the USFWS is not required to follow the guidelines set out by the President's Forest Plan, since the USFWS proposes to harvest timber in the eastern Cascades of Oregon, the USFWS intends to comply with applicable guidelines and current forestry practices that other agencies operate under. While assisting with timber sale administration on USFWS-administered lands to meet USFWS objectives, the BLM has been directed to adhere to the same standards and intent of this guidance that they use for timber harvest in the local area.

Public Access:

Public access is a minor issue since the Bear Valley NWR is closed to public access except during the Oregon deer bowhunting season (50 CFR 32.56). It is estimated that Bear Valley receives between 100-250 hunter use visits annually (Dave Menke, USFWS, pers. comm.)

Land Use Plans/Policies/Controls:

Selection of a preferred alternative should not set a precedent for future actions with significant effects.

H. DECISION TO BE MADE BY THE RESPONSIBLE OFFICIAL

The responsible official must take the input from this Environmental Assessment into account and select the alternative for habitat improvement at Bear Valley NWR that best meets the requirements of bald eagles while considering the environmental consequences. Decisions must also be made whether the proposed action is compatible with the major purposes for which the area was established and whether it would constitute an action significantly affecting the quality of the human environment.

BEAR VALLEY ENVIRONMENTAL
ASSESSMENT

CHAPTER 2

ALTERNATIVES

A. DESCRIPTION OF ALTERNATIVES CONSIDERED

The following is a brief description of each alternative followed by a summary of effects. A complete discussion of the environmental consequences is found in Chapter 4. General silvicultural prescriptions for those alternatives implementing mechanical treatments are presented in Appendix A.

Specific size and location of treatment units have not yet been assigned. The maps of treatment areas within the roost (Figures 3a-3f) depict the intent of each alternative and the general locations and relative sizes of proposed treatments. Timber stand examinations will need to be done to determine stand density, timber volume, species composition, and other variables. Exact boundaries cannot be determined until these data are gathered.

Alternative 1 - No Action alternative

Description of the Alternative:

Habitat improvement, including prescribed fire and thinning, would not be implemented under this alternative. Natural successional processes would be allowed to occur.

Environmental Effects:

The principal environmental effects associated with implementation of this alternative are that timber stand densities, which are already overstocked, will continue to increase. Forest health will decline, white fir will continue to encroach into what has historically been a ponderosa pine/Douglas fir forest type, and sooner or later, a stand-replacement type fire will occur that will destroy the large trees used by eagles. Such a fire will be part of the natural successional process. However, with extensive human use of forested lands in the Klamath Basin there are few, if any, suitable sites nearby for the eagles to use for roosting instead.

Socio-economic Effects:

The principal socio-economic effect that a No Action alternative will have is the threat to firefighter and public safety from a catastrophic wildfire. No direct economic changes would be created by a No Action alternative since no management activities are currently taking place. However, the eventual loss of roost trees in the Refuge to wildfire could be detrimental not only to eagles that use it but

also to the local economy since the eagles attract tourists to the area.

Potential for Controversy:

This proposal is not likely to be immediately controversial to members of the public since it is a continuation of the status quo. There would likely be some discussion about the effectiveness of this option as a management tool as the public becomes more aware of the forest health situation in eastern Oregon caused by many years of fire suppression. It could become controversial and subject to intense scrutiny retrospect in the event of a catastrophic fire.

Concerns:

This alternative would not achieve the project objectives and goals of of protecting and enhancing eagle roosting habitat. Although Bear Valley subroosts may continue to be viable for some time, natural successional processes will eventually alter the habitat in a way that is likely to be detrimental for eagles.

Alternative 2 - Prescribed Fire (figure 3b)

Description of the Alternative:

Under Alternative 2, prescribed fire alone would be used to manage fuel loadings and tree stocking densities at Bear Valley. Fire management units would be defined based on stand composition and logical location of control lines. These units would be burned with a return fire interval ranging between 20 and 80 years, perhaps sooner, based on the fire frequency for this region (DellaSala et al. 1987).

Present fuel loadings would necessitate considerable manual treatment to clear firelines and modify fuels to keep fire intensities within desired limits. If commercial thinning operations were not used to alter the fuel loading before prescribed fire were used, some other form of labor-intensive manipulation of the fuels would be necessary, such as non-commercial thinning operations, brush removal, cutting firelines around individual trees, limbing trees, and so forth. Such labor-intensive methods would require a large number of people devoted to the project for several years to have an impact on the buildup of fuels. Work would be done by Fish and Wildlife fire crew personnel, by other agency personnel such as USFS Hotshot crews, or by contractors.

Environmental Effects:

While prescribed fire may achieve the desired habitat management objectives in parts of the Refuge there would be much less control and predictability to the outcome. It is more likely that the desired effects would not be achieved.

Socio-economic Effects:

This alternative would be very costly for the USFWS to carry out properly; preparing timber stands for burning and carrying out the burns would be very labor-intensive. No resources or money would enter the local economy unless this work is contracted out. In its present condition, prescribed burning in the Bear Valley NWR presents a high risk of escaping control and becoming a destructive wildfire.

Potential for Controversy:

This proposal is more likely to be immediately controversial to members of the public than Alternative 1. Implementation of prescribed fire under this or any other alternative may have negative effects due to smoke produced and the risk of a fire escaping control.

Concerns:

Prescribed fire treatment by itself has little chance of successfully meeting habitat improvement objectives and goals. Prescribed fire is most effective in maintaining stand conditions when vegetation is sparse enough and of the right form that the fire will stay on the ground, consuming unwanted vegetation and accumulations of debris on the forest floor. Ladder fuels, which allow the fire to climb tree trunks into the crowns, exist in most stands and fuel loadings generally exceed levels necessary to adequately control fire. These two factors increase the risk of destroying roost trees and increase the probability of the prescribed fire escaping control. Prescribed fire treatment could be applied safely only to a small portion of the subroosts.

This option would be prohibitively expensive to carry out, especially given the slim chance of a successful outcome. Fire could be used to manage stands after fuel loadings, ladder fuels, and stocking densities were reduced through implementation of Alternatives 3, 4, or 5.

Alternative 3 - Silvicultural Management and Fire I - Preferred Alternative (figure 3c)

Description of the Alternative:

This alternative emphasizes the use of commercial and non-commercial thinning operations in combination with prescribed burning to achieve desired stocking densities and species composition in treatment stands. This alternative would treat approximately 1500-1800 acres over a ten to fifteen year period.

An adaptive management approach will be used. Under this approach, the overall goals and approximate parameters have been defined but the specific details have only been determined for the first two years' activities. The second commercial thinning entry will be modified

based on the results of the first year's harvest. Subsequent treatment activities will likewise be improved as a result of the previous thinning operations.

The majority of the first year's treatment would occur in an area which is outside the subroosts. This area has been identified by members of the IDT as an area which is not currently receiving much eagle use but which has excellent potential for becoming roosting habitat. A risk assessment performed by BLM and USFS forestry professionals indicates that this area is reaching the age where forest health problems may increase in the near future (Andy Eglitis, unpubl. data). It will serve as a test area to evaluate the effect of treatment without jeopardizing significant parts of known subroosts.

Parts of subroosts 2 and 3 are included in this treatment area in order to establish feasible boundaries for commercial thinning operations and to include areas of known eagle use in order to begin assessing eagle response.

The first year's thinning activities will test two different silvicultural prescriptions. Complete details of each prescription are found in Appendix A. The areas to be treated with each prescription are shown in figure 4, Appendix B.

Part of the area will be thinned to a timber stand density that was originally recommended by DellaSala et al. (1987) to maximize individual tree size, open-branched characteristics, and maximum number of large trees per acre. The general prescription from that study was modified into a detailed, site-specific prescription by a BLM silviculturist who also incorporated local experience of the BLM, the Winema National Forest, and Weyerhaeuser Co. at managing bald eagle habitat. This prescription will be referred to as "Prescription A". In general, Prescription A will target a 20 foot spacing of all desired tree species in all size categories, leaving an average of 121 trees/acre in treated stands.

A different silvicultural prescription will be used in identified subroosts within the first year treatment area. In this second prescription, no trees larger than 14" would be cut; only the smaller, understory trees would be thinned. This prescription will be referred to as "Prescription B".

Eagle monitoring would begin prior to the first year's thinning (Appendix B). After the first year's thinning operations, logging operations will cease until monitoring has been completed and the IDT has a chance to observe the results obtained by the two prescriptions. If monitoring shows no negative effects on eagles utilizing the Refuge, subsequent treatment activities will be based on the most suitable prescription and the IDT's recommendations on how it can be improved. Each treatment is planned as a single-year commercial thinning sale, followed by additional monitoring and consultation for a period of one or two years before the next treatment area is thinned. With one year of monitoring between each treatment year this

habitat improvement activity could be completed in ten years. Additional years of monitoring between treatments will lengthen the amount of time to completely treat the subroost areas.

The boundaries of the second treatment area will be determined by threats to roost trees, the relative importance of the roost areas, the probability that treatment would decrease the threats, and timber sale administration considerations. Note that figure 3c represents only the intent of this alternative in terms of its multi-year treatment plan and the approximate extent. The boundaries of each year's treatment activity may not be the same as those depicted on the map since treatment boundaries cannot be determined until more detailed timber stand exams have been completed. Further analysis of the stand composition may recommend splitting some year's sales into two or three separated units as is shown for Treatment Area 3 in figure 3c. Separating the treatment blocks may be necessary from a practical aspect: higher elevation areas may require considerable fuels treatment, which may render them unprofitable compared to easier-to-treat lower elevation areas. By tying a unit of lower elevation forest with an unsalable higher elevation unit in the same thinning sale, an economically viable package deal may be created.

Treatment Area 2 as depicted in figure 3c has been identified as a likely priority but as additional expert input is obtained, other areas may be shown to be more in need of treatment. A forest health risk assessment done by the USFS did not indicate any pressing reasons why the order of treatment shown in figure 3c should be changed (Andy Eglitis, unpubl. data).

This alternative will utilize conventional ground-based harvest operations which are generally limited to slopes of less than 35%. The lower elevation subroost areas can be treated completely; higher elevation sites with steeper slopes in subroosts 3 and 4 would receive minimal treatment. Some of these steeper slopes which cannot be harvested economically with cable systems may require specialized ground-based equipment. No helicopter logging is proposed but some cable logging may be necessary.

Slash remaining after commercial thinning operations would be treated by the contractor as an integral part of the contract. The goal of slash treatment, whether mechanical or through burning, is to reduce fuel loadings and wildfire potential. Roads necessary for logging operations would also be improved by the contractor as an element of the timber sale contract.

Prescribed fire units would later be defined across the mechanically treated areas and burning would be implemented when fine fuel loading (generally considered as 1 and 10 hour fuels, Rothermel 1983) increases above acceptable levels. Return fire interval to treated units would likely range between 20 and 80 years, perhaps sooner, based on the fire frequency for this region (DellaSala et al. 1987).

Non-commercial treatment would be applied to individual roost trees on

slopes too steep for conventional ground-based operations. These trees would be cultured, meaning that all brush and small diameter trees (≤ 5 inches Diameter at Breast Height (DBH, that is, the tree diameter at a point 4.5' above ground level) would be removed from a 30 foot radius around roost trees located on slopes greater than 35% outside treatment units. Slash would be hand-piled and left for wildlife habitat. This treatment would be accomplished by USFWS fire crews.

Environmental Effects:

This alternative would accomplish the desired habitat management objectives in a much more predictable manner than the previous two alternatives. The silvicultural prescriptions on which it is based take into account the biological conditions necessary to perpetuate eagle roost habitat. The two different prescriptions to be used initially will help to obtain optimal timber stand characteristics for bald eagle roosting.

Socio-economic Effects:

The risk of catastrophic wildfire and the resulting threats to firefighter and public safety would be reduced, but negative effects due to smoke produced and the risk of a fire escaping control would be increased. These effects are associated with all prescribed fire activities and are not unique to this alternative.

A commercial thinning sale would probably have a positive effect on the local and/or regional economy as a result of increased employment and use of natural resources. Klamath County may see an increase in revenue sharing payments as a result of the action.

Potential for Controversy:

Controversy is likely to be centered on the extent and timeframe of treatment activities. Initial scoping and consultation with resource specialists suggested support for managing bald eagle roosting habitat with commercial and non-commercial thinning and fire.

Some objection may be raised to habitat improvement via a timber sale in a wildlife Refuge, especially since revenues will be generated as a result of the activity. The sale of Refuge timber may be viewed by some as an activity incompatible with the purpose for which the refuge was established if it is not understood that the sale is a byproduct of habitat improvement actions and not the management goal for the Refuge.

Objections to a timber sale on Refuge land are likely to become more emphatic if larger timber is removed during commercial thinning operations. If larger timber is to be removed, the USFWS should be prepared to demonstrate that there is a sound silvicultural basis for removing these trees and that adequate monitoring of markers and logging contractors is occurring to prevent unintended removal of

large trees.

Concerns:

This alternative treats a significant amount of eagle habitat in an economically realistic way. The time period that the treatment is spread out over allows room for error. If eagle response is unfavorable, treatment can be stopped or altered in time to prevent total loss of the existing habitat.

Alternative 4 - Silvicultural Management and Fire II (figure 3d)

Description of the Alternative:

This alternative also emphasizes the use of commercial and non-commercial thinning operations in combination with prescribed burning to achieve desired stocking densities and species composition in treatment stands. It would treat approximately 1500-2000 acres with one three-year timber sale.

Conventional ground-based harvest operations would occur in all subroosts. Higher elevation areas would be logged with cable logging systems or helicopters since they are too steep for conventional ground-based logging. Additional units outside of the subroost areas would also be treated and managed for future roosting habitat.

In general, the prescription will target a 20 foot spacing of all desired tree species in all size categories, leaving an average of 121 trees/acre in treated stands (Appendix A - Prescription A). Slash remaining after commercial thinning operations would be treated by the contractor as an integral part of the contract. The goal of slash treatment, whether mechanical or through burning, is to reduce fuel loading and wildfire potential. Roads necessary for logging operations would also be improved by the contractor as an element of the timber sale contract.

Prescribed fire units would later be defined across the treated area and burning would be implemented when fine fuel loadings (generally considered as 1 and 10 hour fuels, Rothermel 1983) increase above acceptable levels. Return fire interval to treated units would likely range between 20 and 80 years, perhaps sooner, based on the fire frequency for this region (DellaSala et al. 1987).

Non-commercial treatment would be applied to individual roost trees on slopes too steep for conventional ground-based operations. These trees would be cultured, meaning that all brush and small diameter trees (5 inches DBH or less) would be removed from a 30 foot radius around roost trees located on slopes greater than 35% outside treatment units. Slash would be hand-piled and left for wildlife habitat. This treatment would be accomplished by USFWS fire crews.

Comparison to Other Alternatives:

This alternative is similar to Alternative 3 in practice but treats more acres without waiting for monitoring of eagle response. The biggest difference between alternatives 3 and 4 is that Alternative 4 would be planned as one treatment carried out over 3-5 years. Evaluation of eagle use would not take place until after the unit has been treated.

This alternative is based on the assumption that the preservation of eagle habitat is primarily a forest health issue and that management activities should be focused on proven methods of maintaining and producing large, healthy trees suitable for roosting. The other characteristics eagles prefer for a roost site - a convenient source of food, sheltered slopes, and lack of human presence - are already present, so if large trees are present, eagles will use those trees.

Manipulating eagle habitat with silvicultural treatment is not an untried concept. There are few documented references in the literature of the relationships between silvicultural treatment and eagle response but other land managers in the area report a decrease in tree mortality in similarly treated areas with no decrease in eagle use (Chris Sokol, Weyerhaeuser, pers. comm.; Rick Hardy, Winema National Forest, pers, comm.). Since this technique has already been shown to be effective at reducing tree mortality this alternative will do the most to relieve a potential forest health problem in the shortest time.

Environmental Effects:

This alternative will satisfy the problems, opportunities or needs identified in Chapter 1 to a great extent since it treats the largest area and is based on a silvicultural prescription which takes into account the biological conditions necessary to perpetuate eagle roost habitat.

Socio-economic Effects:

The risk of catastrophic wildfire and the resulting threats to firefighter and public safety would be reduced, but the negative effects due to smoke produced and the risk of a fire escaping control associated with all prescribed fire activities would be increased.

This alternative would create the largest commercial thinning sale and would have the greatest effect on the local and/or regional economy. Klamath county would have the best chance of seeing an increase in revenue sharing payments as a result of the action.

Potential for Controversy:

Initial scoping and consultation with resource specialists suggested support for managing bald eagle roosting habitat with commercial and non-commercial thinning and fire. Controversy is likely to be

centered on the extent and timeframe of treatment activities because no allowance is made for monitoring eagle response before treating the entire roost area.

Some objection may be raised to habitat improvement via a timber sale in a wildlife Refuge, especially since revenues will be generated as a result of the activity. The sale of Refuge timber may be viewed by some as an activity incompatible with the purpose for which the refuge was established if it is not understood that the sale is a byproduct of habitat improvement actions and not the management goal for the Refuge.

Concerns:

Although this alternative is likely to produce many of the desired biological effects, treating all of the subroosts at one time leaves more uncertainty about the outcome than Alternative 3.

Alternative 5 - Silvicultural Management and Fire III (figure 3e)

Description of the Alternative:

This alternative emphasizes the use of commercial and non-commercial thinning operations in combination with prescribed burning to achieve desired stocking densities and species composition in treatment stands. One commercial timber sale over two years will treat a total of approximately 500-700 acres. Only half of each subroost will be treated; the other halves would be left to progress under natural successional processes. Once the treatment has been completed, the monitoring process can take as long as needed. If monitoring demonstrates positive response by eagles to silvicultural treatments then a new habitat improvement plan would need to be drafted and implemented to treat the rest of the subroosts.

This alternative will utilize conventional ground-based harvest operations which are generally limited to slopes of less than 35%. No helicopter or cable logging is proposed. A small amount of additional forest outside of the subroosts would also be treated and managed for future roosting habitat.

In general, the prescription will target a 20 foot spacing of all desired tree species in all size categories, leaving an average of 121 trees/acre in treated stands (Appendix A - Prescription A). Slash remaining after commercial thinning operations would be treated by the contractor as an integral part of the contract. The goal of slash treatment, whether mechanical or through burning, is to reduce fuel loadings and wildfire potential. Roads necessary for logging operations would also be improved by the contractor as an element of the timber sale contract.

Prescribed fire units would later be defined across the mechanically treated area and burning would be implemented as described for

alternatives 3 and 4 above.

Non-commercial treatment would also be applied under this alternative as described in alternatives 3 and 4 above.

Comparison to Other Alternatives:

This alternative tries to strike a balance between an experimental manipulation of eagle habitat which does not jeopardize all of the subroosts but still treats a significant portion of the Refuge in an economically feasible manner. It is similar to Alternatives 3 and 4 in practice but treats fewer acres than either of the other two thinning alternatives.

Environmental Effects:

The principal environmental effects associated with implementation of this alternative will be a mix of the effects of Alternative 3 and Alternative 1. The desired biological effects such as increases in forest health and reduction in white fir would be present to some extent in the treated areas while negative effects, such as continuing increases in stand density and wildfire potential, will continue in the untreated areas.

Socio-economic Effects:

Positive effects on the local economy and the possibility of Klamath county seeing an increase in revenue sharing payments as a result of the action are smaller.

Potential for Controversy:

Even though it is more limited in scope, implementation of this alternative is still likely to result in some public controversy for the same reasons as the two previous treatment alternatives. This may be the least controversial of the treatment alternatives because of the balance of its plan.

Concerns:

This alternative could be expected to achieve the desired project objectives for eagle habitat improvement on a limited basis. The limited amount of area to be treated prevents this from being completely effective as a habitat improvement plan.

Alternative 6 - Silvicultural Experimentation (figure 3f)

Description of the Alternative:

This alternative would test hypotheses about eagle response to various treatments in a rigorous experimental framework. Six plot triads for a total of 60 acres would be treated in order to evaluate eagle

response to various manipulations. Two different prescriptions would be replicated and tested; a 10 foot spacing among residual trees and a 20 foot spacing. After a 3-year monitoring period, data would be analyzed to determine which treatment, if any, is most suitable for eagle roost tree improvement. Appropriate treatments would then be applied across a broader area of the subroosts (conforming to Alternatives 3, 4, or 5) in a new habitat improvement plan. Appendix A describes the prescription in more detail.

Comparison to Other Alternatives:

This alternative will not by itself maintain existing bald eagle roosting habitat over the long term but will only give indications of what will be effective in a later habitat improvement project.

Environmental Effects:

The desired future habitat condition will only be achieved on small plots within the roost. Future habitat improvement projects which may be developed based on the results will take a number of years to implement and untreated areas may be lost to potential forest health problems or wildfire in the interim.

Socio-economic Effects:

This alternative will have very little if any effect on the local economic situation. Due to the small scale of thinning operations it will probably cost the USFWS money to prepare the experimental blocks. No additional work will be accomplished during this phase of the project.

Potential for Controversy:

Controversy over this experimental design will probably center on whether it is worth gambling that data can be collected and further habitat improvement work completed before irreparable damage is done to the Bear Valley roost.

Concerns:

This alternative would not achieve the project objectives and goals of maintaining eagle roosting habitat at the landscape scale. Subsequently, fuel loadings would worsen and risk of wildfire would increase. A cooperative research project such as this was proposed in the original Environmental Impact Assessment (p. I-4) to determine vegetation management desirable in the core area and buffer zone (U.S. Fish and Wildlife Service, 1978). However, in the 17 years that have passed since the assessment was released, fuel loading has increased significantly and silvicultural manipulation has been demonstrated to be effective at reducing stand densities while retaining eagle use. If thinning of larger areas isn't completed, there is potential for loss of entire subroosts.

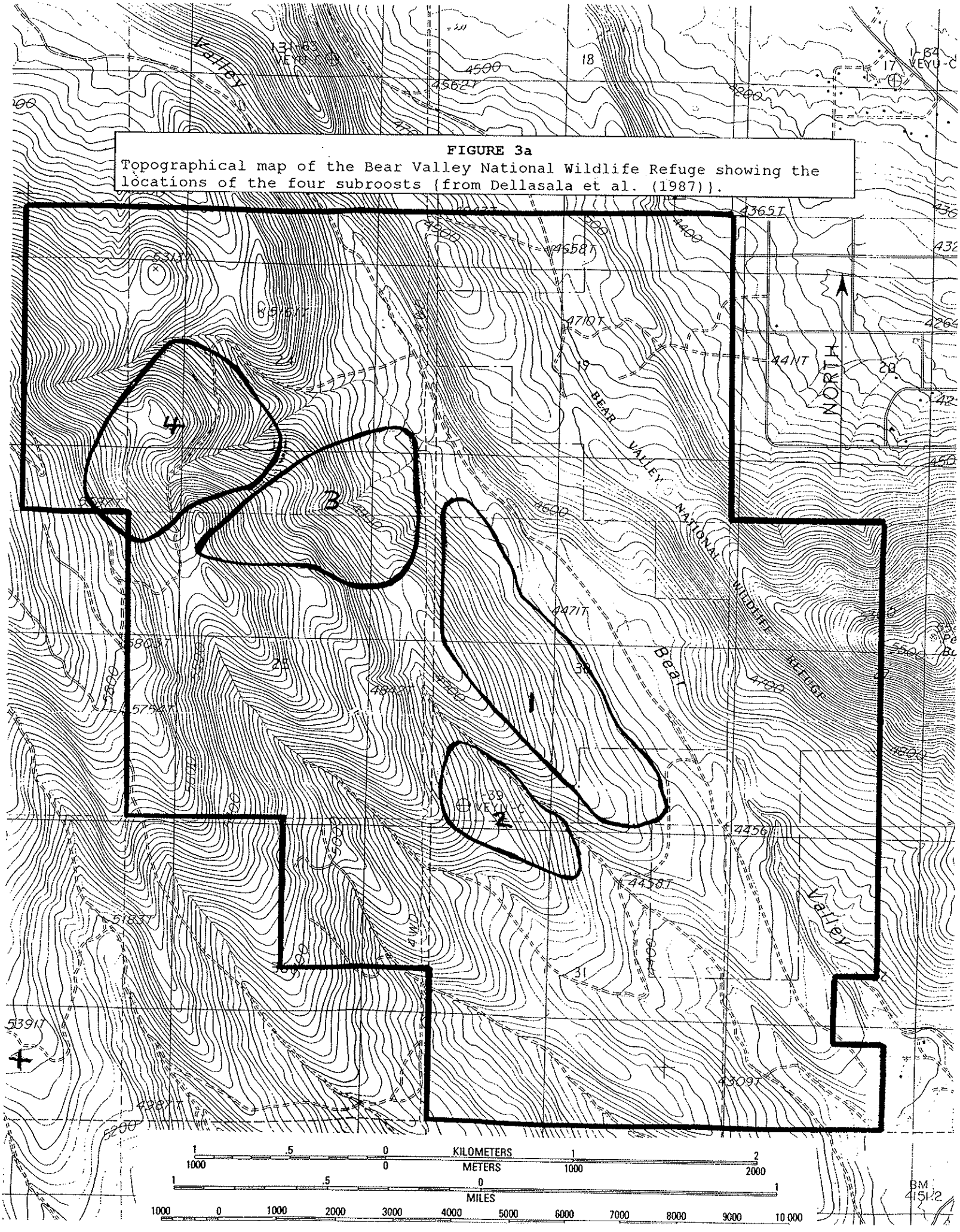


FIGURE 3a

Topographical map of the Bear Valley National Wildlife Refuge showing the locations of the four subroosts (from Dellasala et al. (1987)).

FIGURE 3b

ALTERNATIVE 2 - Prescribed Fire

Boundaries shown are representations of prescribed fire units. Actual locations and sizes of these units have not been established but will be based on timber stand composition and logical location of control lines.

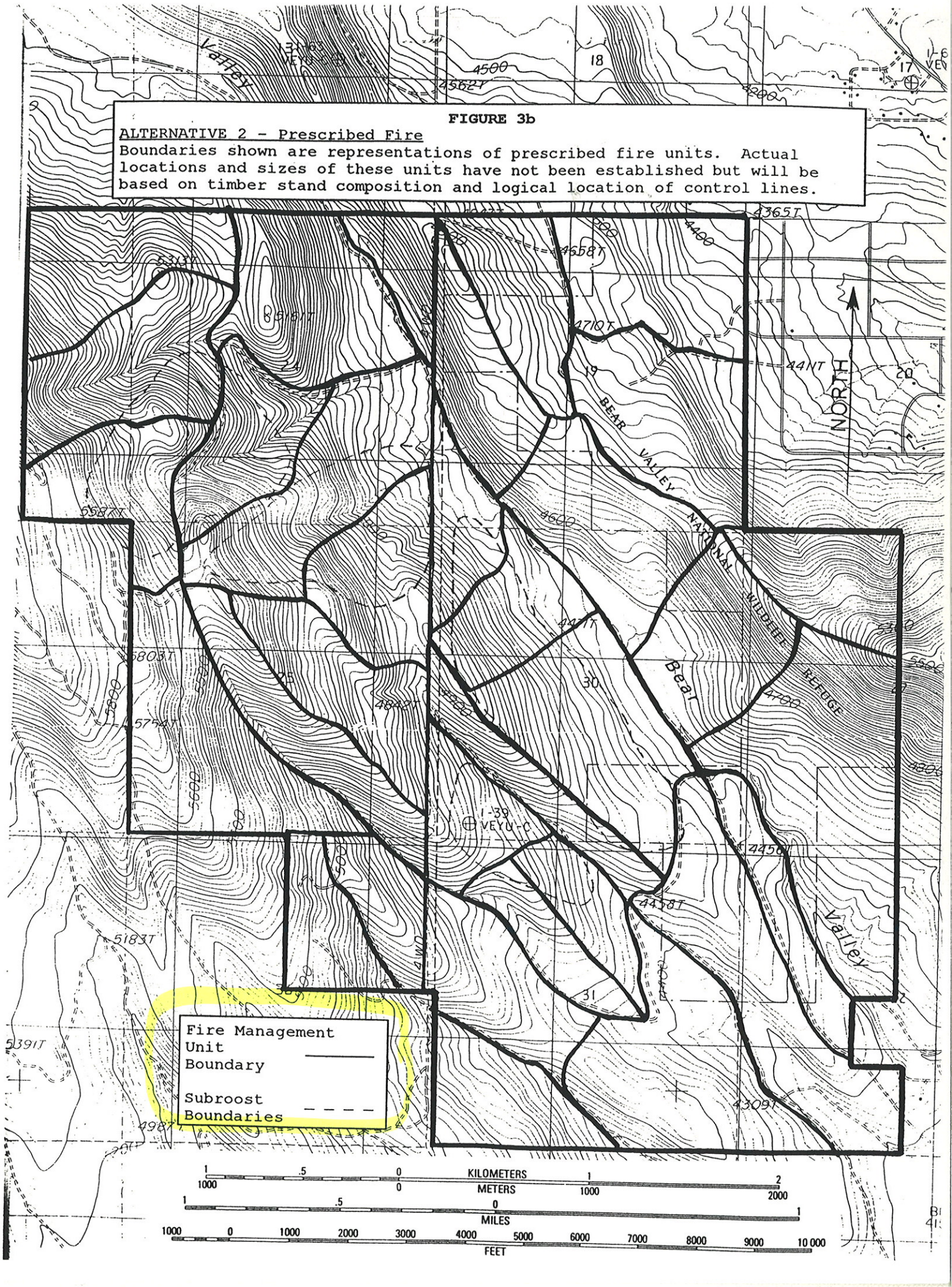


FIGURE 3c

ALTERNATIVE 3 - Silvicultural Treatment and Prescribed Fire I (Preferred Alternative). 1500-1800 acres treated in five timber sales over 10-15 years. **Treatment Area 1** depicts the actual boundary of the first area to be thinned. The other boundaries shown are representations of the extent of treatment areas and how they will progress. Actual locations and sizes of **Treatment Area 2** will be based on input of an Interdisciplinary Team of experts after monitoring the results obtained in Treatment Area 1. This adaptive management approach will continue in this manner through all five proposed treatment areas.

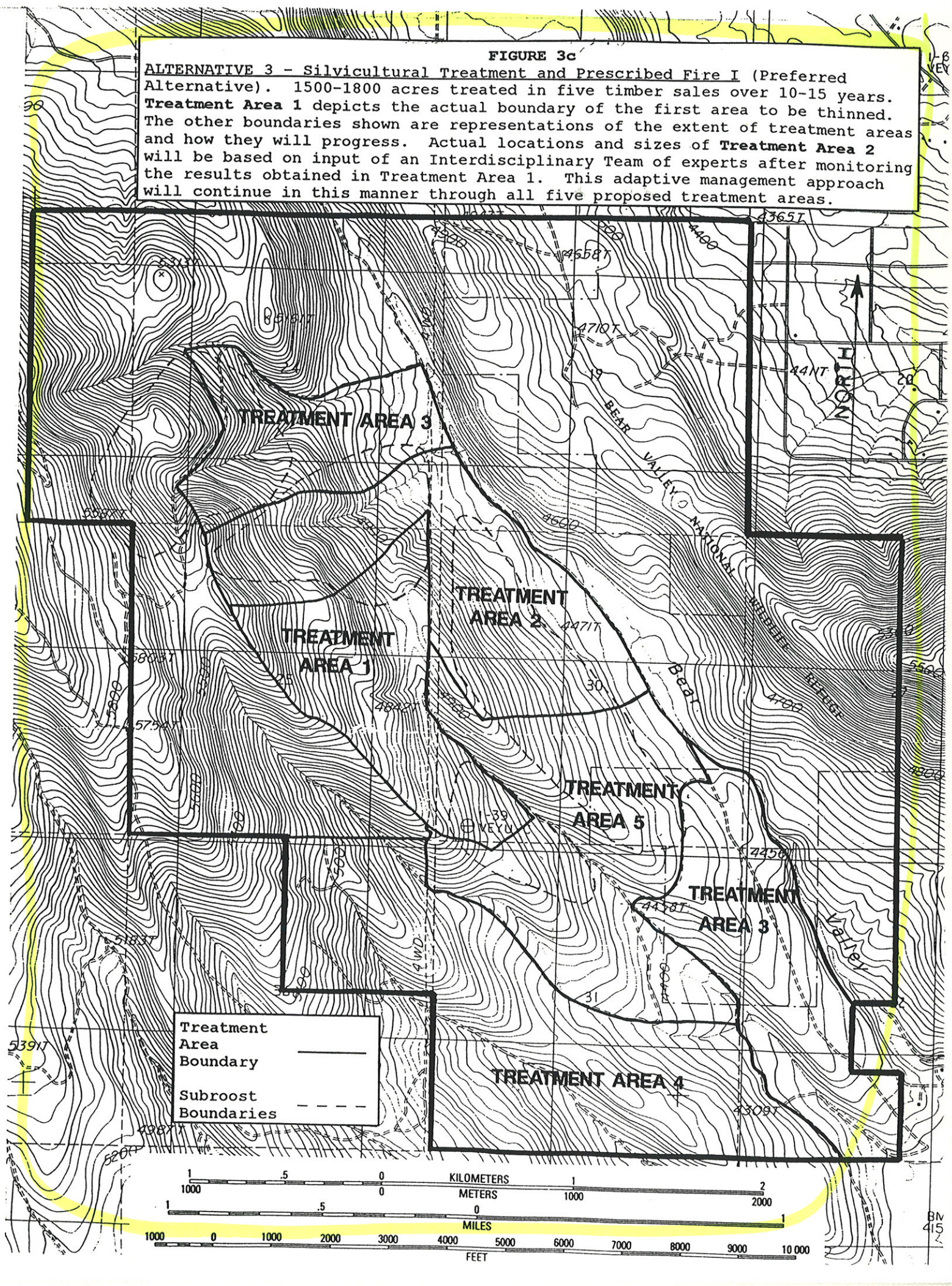
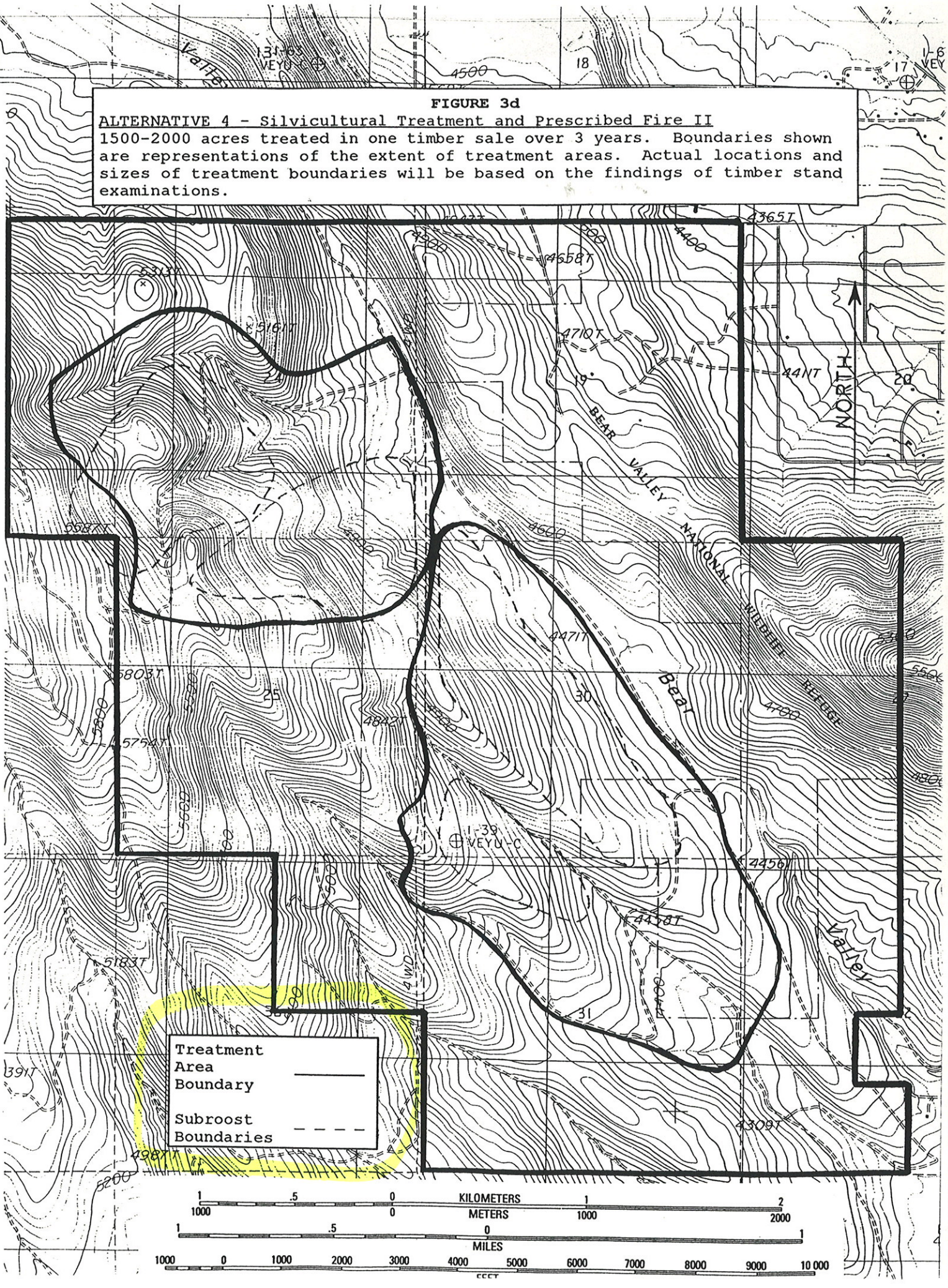


FIGURE 3d

ALTERNATIVE 4 - Silvicultural Treatment and Prescribed Fire II
1500-2000 acres treated in one timber sale over 3 years. Boundaries shown are representations of the extent of treatment areas. Actual locations and sizes of treatment boundaries will be based on the findings of timber stand examinations.



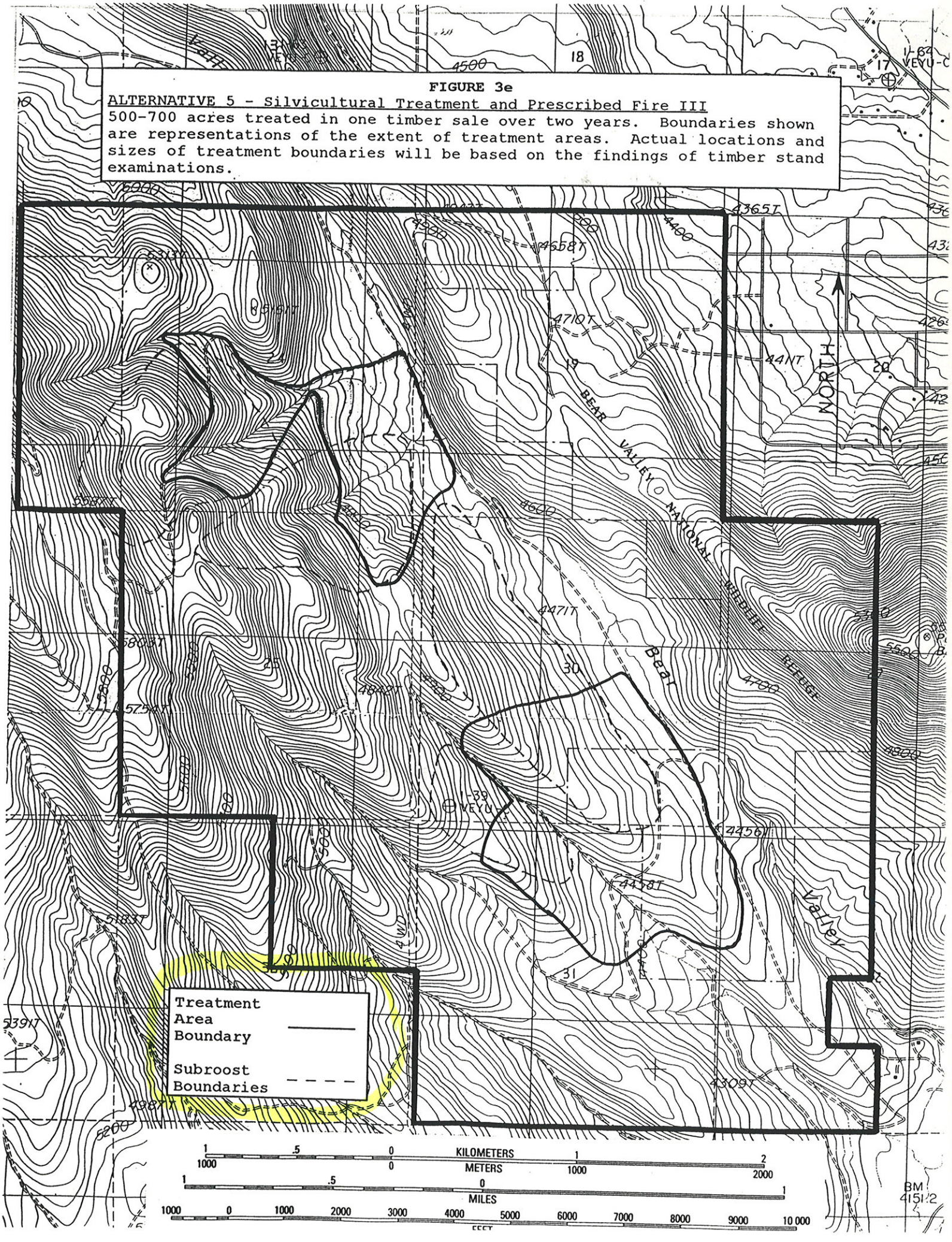
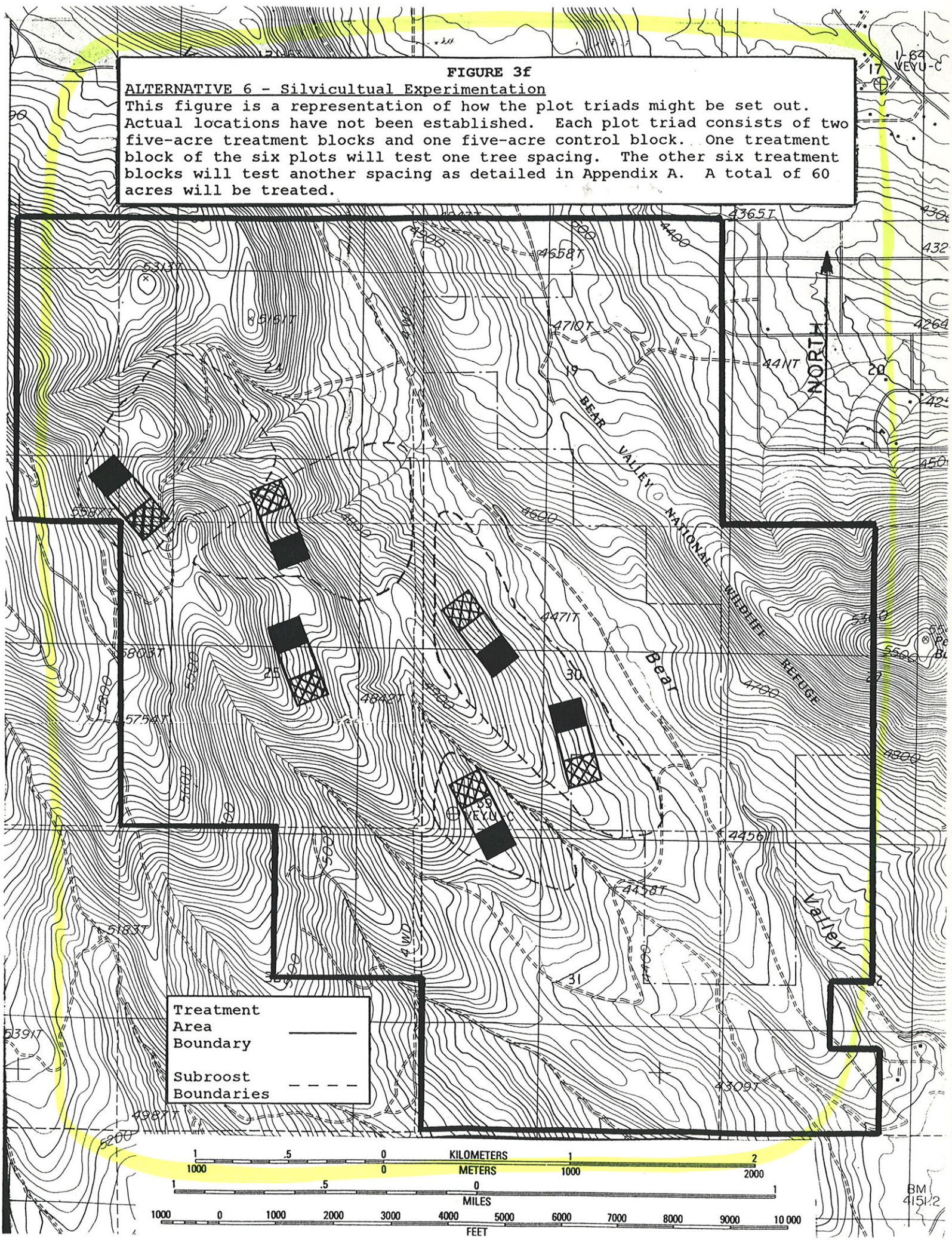


FIGURE 3e
ALTERNATIVE 5 - Silvicultural Treatment and Prescribed Fire III
500-700 acres treated in one timber sale over two years. Boundaries shown are representations of the extent of treatment areas. Actual locations and sizes of treatment boundaries will be based on the findings of timber stand examinations.
Treatment Area Boundary
Subroost Boundaries
NORTH
BEAR VALLEY NATIONAL WILDLIFE REFUGE
Bear Valley
I-39 VEYU
I-84 VEYU-C
KILOMETERS
METERS
MILES
FEET
BM 4151/2

FIGURE 3f

ALTERNATIVE 6 - Silvicultual Experimentation

This figure is a representation of how the plot triads might be set out. Actual locations have not been established. Each plot triad consists of two five-acre treatment blocks and one five-acre control block. One treatment block of the six plots will test one tree spacing. The other six treatment blocks will test another spacing as detailed in Appendix A. A total of 60 acres will be treated.



B. ELEMENTS COMMON TO ALL ALTERNATIVES

With the exception of the No Action Alternative, all other alternatives described in this chapter have the following elements in common:

1. **Bald eagle monitoring** would be conducted under each alternative. Eagle "flyout" counts, midwinter counts, and nest occupancy/production surveys (Isaacs and Anthony 1993) would continue each year following treatment. Intensive monitoring of bald eagle response to habitat treatments (described in Appendix B) should be conducted for at least 2 years following treatment.

2. **Timber stand examinations** will be conducted before treatment to evaluate vegetation characteristics and fuel loadings on the Refuge. Stand exams typically used by the U.S. Forest Service (U.S. Forest Service 1991) and BLM will most likely be employed for data collection. Stand exam data could also be modeled with silvicultural programs such as PROGNOSIS and OREGONON, and incorporated into layers for GIS analysis. Post-harvest exams, using the same methods as stand exams, would also occur following treatment.

3. **Historical resources will be protected.** An archaeological survey of the Bear Valley NWR found no cultural sites, however, three historical sites were discovered and documented (U.S. Fish and Wildlife Service 1995). Management activities and planning will take into account the location and nature of these historic sites so that disturbance to them may be avoided.

4. **A fire management plan** will be prepared and would include initial attack plans, location of and/or prior construction of helispots, and establishment and location of fuel breaks. Refuge fire personnel or cooperators would attempt to suppress all wildfires occurring on the Refuge. Preparatory activities for such a plan would occur when eagles are not present at the roost.

5. **Prescribed burning** would be employed in all alternatives to reduce fuels and sapling stocking density in mechanically treated stands. Specific burn plans for each management unit would be prepared prior to treatment. Prescribed burning would occur only when eagles are not present at the roost.

6. **Smoke management.** Management of the smoke from any prescribed burns is feasible and will be undertaken according to established smoke management principles. All applicable state and federal air quality laws and regulations will be complied with. Public contact with local communities and homeowners in the area to explain the reasons for prescribed burning may lessen the impact of and complaints about the smoke produced.

7. **Fire breaks** would be created along major roads throughout the project area by removing brush and saplings from a specified

distance from each side of the designated road. Clearings for safety zones for fire suppression personnel and/or helispots will be created as needed in areas that won't affect roost trees.

8. **Road maintenance and gate construction** will be performed under each alternative. Existing roads to be used as haul routes will be upgraded to necessary standards. Existing roads and skid trails will be used for removing timber as much as possible. Some roads may be constructed, such as temporary roads used for product removal and relocation of permanent roads from their current location in drainages. Current environmental protection standards as used by the BLM would be used for any new road construction. For example, new roads would not enter riparian areas. Roads not needed after the project is completed will be rehabilitated. The Refuge would remain closed to all vehicular traffic except for USFWS administrative activities. New gates would be installed at all entrance points to the Refuge under this project.

C. MITIGATION MEASURES COMMON TO ALL ALTERNATIVES

With the exception of the No Action Alternative, all other alternatives described in this chapter have the following mitigation measures in common:

1. **Bald Eagle Nesting.** No harvest activities will occur within 1/2 mile of active eagle nests on the Refuge from January 1 through August 15 each year, and disturbance to the nests by other management activities will be limited. Non-harvest activities, such as monitoring or tree marking activities, within 1/2 mile of the nests will be carefully monitored to determine if disturbance is taking place. Because this nest is not within line-of-sight of non-harvest activities, no adverse effects are anticipated.

Three active eagle nests are known to exist at Bear Valley. Nest productivity is monitored each year by the Oregon Cooperative Wildlife Research Unit. Established guidelines (U.S. Fish and Wildlife Service 1986, U.S. Forest Service 1990) call for a lack of disturbance within 1/2 mile of active nests through August 31. However, some part of each planned treatment area falls within 1/2 mile of one of these nests, as do most of the roads necessary for access; total prohibition of human activity within 1/2 mile of the active nests would severely handicap the ability of the USFWS to perform necessary preparatory work and monitoring activities. Full Section 7 concurrence (Endangered Species Act) will be received prior to harvest or pre-harvest activities.

In February, 1996, Frank Isaacs and Monte Garret of the Oregon and Washington Bald Eagle Working Team suggested that more flexibility in activity around active nests may be possible without causing nest failure. They proposed the above solution to this problem. The rational behind this recommendation is that the true objective is not an absolute 1/2 mile buffer around active nests that can't be entered but is instead to limit human disturbance in the areas that are

visible to eagles from their nests, especially during critical early parts of the rearing cycle. Topography and visibility become more critical factors than distance. For example, people walking on the ground under the timber canopy will probably not disturb an active eagle nest on the opposite side of a ridge even though they are working less than 1/4 mile from the nest. The likelihood of eagles abandoning an active nest becomes less the later in the season the disturbance occurs as the chicks are getting larger. Activities which cause disturbance in April would probably have no effect on the success of the nest if they happen in early August. The August 15 date was suggested as a realistic date for nests in this area when mechanical activities could begin without adversely affecting nesting activities.

The USFWS will maintain contact with the Oregon Cooperative Wildlife Research Unit who monitor eagle nest activity throughout the state and will perform monitoring activities to follow the nests' progress.

2. **Bald Eagle Roosting.** Vehicular access and harvest activities will generally be restricted during the roosting period from 1 November through 15 April each year.

3. **Roost Trees.** Known bald eagle roost trees will not be removed for any reason during this project. Roost trees will be identified on a tree by tree basis as any tree, alive or dead, over 14" diameter which has any eagle castings of any age around the base of it. Previous markings and tagging of roost trees will not be relied on to verify roost tree status, however, if a tag or mark is present this will confirm that a tree is a known roost tree. Identification of roost trees will be made by trained personnel under the direction of a wildlife biologist

4. **Forest Health and Productivity.** Non-commercial thinning will further reduce stocking densities and improve growth and vigor of leave trees. Since residual trees have loose bark and are easily damaged in the spring, commercial thinning will not be allowed at this time. If felling is the chosen method for cutting trees, then directional felling, away from residual leave trees, will be required. If necessary, borax would be applied to stumps to discourage the attraction of pathogens and/or insects.

5. **Tree Regeneration.** Ponderosa pine and Douglas-fir seedlings would be planted in treated stands, as needed, to achieve desired stocking densities of these species.

6. **Soils, Riparian, and Slopes.** Riparian areas will be buffered from harvest activity following the current standards that the BLM adheres to in their timber sales activities. Tractors and other equipment will not be allowed in riparian areas. Ground-based equipment will generally be restricted to slopes of 35% or less although some small areas of steeper slopes may be included to make the treatment areas economically viable. Specialized equipment capable of working on steeper slopes without damaging soils may be specified in the contract

based on recommendations of BLM timber sale planners. Logging equipment will generally be restricted to skid trails and roads to reduce soil compaction. Rocky areas which may be unsuitable for ground based logging will not be entered.

7. Snags, Dead and Down Material. Large snags (greater than 14" DBH) will be maintained in treatment units as often as possible. Details are found in the Silvicultural Prescription A, Appendix A. Most smaller snags may be removed in treatment units to reduce the wildfire and injury hazards created by snags. Untreated units will continue to provide snags for eagles, the cavity nester guild, and other wildlife. Large dead and down logs will be maintained within treatment stands (generally following U.S. Forest Service guidelines {U.S. Forest Service, 1990}).

8. Endangered/threatened Plant and Animal Species. The Endangered Species Division of the Fish an Wildlife Service will be consulted in compliance with Section 7 of the Endangered Species Act to determine whether the proposed actions will have a harmful effect on any endangered or threatened plants or animals. Informal consultation with the Endangered Species Division has already begun and has resulted in several changes in this document. Due to the multiple treatment activities proposed in some of the alternatives, each stage of the selected alternative may be submitted for consultation separately.

D. MATRIX OF ALTERNATIVES

Decision-Making Criteria	Alternatives					
	No Action Alternative	Alternative 2 Prescribed Fire	Alternative 3 Silvicultural Treatment and Prescribed Fire I	Alternative 4 Silvicultural Treatment and Prescribed Fire II	Alternative 5 Silvicultural Treatment and Prescribed Fire III	Alternative 6 Silvicultural Experimentation
Area to Be Treated/ Timeframe	None	Entire Refuge divided into prescribed burn units and burned in rotation on a 20-80 year interval	1500-1800 acres treated in five timber sales over 10-15 years	1500-2000 acres treated in one timber sale over three years	500-700 acres treated in one timber sale over two years	60 acres treated (12 experimental plots of 5 acres each) prepared in one year
Reduce Potential Forest Health Problems by Reducing Stocking Density	No	Yes, but likely to destroy many roost trees in the process	Yes - Good	Yes - Best	Yes - Fair	No
Maintain Existing Bald Eagle Roosting Habitat	No	High danger of destroying many roost trees	Yes - Good	Yes - Good	Yes, but only over half of each subroost	No
Provide for Replacement Roost Trees	No, but current stands are adequate for the next hundred years	Yes, but only by chance	Yes - Best	Yes - Good	Yes - Fair	No, but current stands are adequate for the next hundred years
Increase Desired Roost Tree Species	No	Yes - Poor	Yes - Good	Yes - Good	Yes - Fair	No
Thin White Fir	No	Yes	Yes	Yes	Yes, but only over half of each subroost	Only in experimental thinning units
Eagle Response	Will take many years to determine	Unknown	Good - Allows time to determine while proceeding	Poor - Doesn't allow time to determine before proceeding	Better - Allows time to determine before proceeding	Best - designed to determine eagle response
Reintroduce Fire	No	Yes, but likely to destroy roost trees in the process	Yes, does so while preserving roost trees	Yes, does so while preserving roost trees	Yes, does so while preserving roost trees but only over half of subroosts	Only in treated units

MATRIX OF ALTERNATIVES (continued)

Decision-Making Criteria	Alternatives					
	No Action Alternative	Alternative 2 Prescribed Fire	Alternative 3 Silvicultural Treatment and Prescribed Fire I	Alternative 4 Silvicultural Treatment and Prescribed Fire II	Alternative 5 Silvicultural Treatment and Prescribed Fire III	Alternative 6 Silvicultural Experimentation
Reduce the Probability of Catastrophic Wildfire	No	Yes, but increases risk from escaped prescribed fire	Yes - Good	Yes - Best	Yes - Fair	No
Safety of Suppression Forces	High hazard	Wildfire hazard decreased but high danger from prescribed fire	Hazard reduced	Hazard reduced	Hazard reduced to some extent	High hazard
Public Safety	High hazard	Wildfire hazard decreased but high danger from prescribed fire	Hazard reduced	Hazard reduced	Hazard reduced to some extent	High hazard
Air Quality (Smoke)	No effect	Greatest effect	Significant effect	Significant effect	Moderate effect	Insignificant effect
Costs	None	High	Low	Lowest	Low	Moderate
Tax Base/ Revenue Sharing with County	No effect	No effect	Potential increase	Highest potential for increase	Potential increase	No effect
Local Employment	No effect	Increased if pretreatment or burning is contracted	Increased	Highest increase	Somewhat increased	Little or no effect
Potential for Controversy	Probably Low	Probably Low	Moderate - Timber sale on Refuge land. Also, smoke.	Moderate to High - Timber sale on Refuge land. Also, treating all subroosts without waiting to determine eagle response	Low to Moderate - Timber sale on Refuge land	Probably Low

BEAR VALLEY ENVIRONMENTAL ASSESSMENT

CHAPTER 3

AFFECTED ENVIRONMENT

This section provides more background information on the environmental components within the Bear Valley NWR potentially affected by implementation of alternatives presented in this Environmental Assessment.

CLIMATE

Climate in the Klamath Basin is generally characterized by hot, dry summers and cold, wet winters. In Bear Valley, average annual temperatures range between 40 and 49° F. Annual precipitation, mostly in the form of snowfall, ranges between 10 and 50 inches (Keister and Anthony 1983). Both temperature and precipitation vary with elevation, slope, and aspect. Relative humidity ranges from 10-20% in summer and averages 75% in winter, contributing to high fire-risks in the area (U.S. Fish and Wildlife Service 1978, DellaSala et al. 1987). Prevailing winds are usually from the south and west.

GEOLOGY AND SOILS

The Klamath Basin of Southcentral Oregon is of volcanic origin. Cinder cones and lava flows of the Miocene to recent age surround the basin. Elevations within Bear Valley range from 4,090 to over 6,500 feet on Hamaker Mountain. Core roosting areas general lie on north and east slopes.

The principal soil type at Bear Valley is Woodcock stony loam, which is common on 5-40% slopes and is derived from weathered andesite, other felsites, basalt, and minor amounts of pyroclastic rocks and ash. This soil type is usually found in cooler sites with higher precipitation levels (18-25 inches) and typically supports forest tree species. Less prevalent soil types include Lobert loam, Calimus loam, Lorella very stony loam, Royst stony loam, and Dehlinger very stony loam, usually on more xeric sites. These soils generally support juniper (*Juniperus* spp.), mountain mahogany (*Cercocarpus* spp.) and other woody shrubs, and grasses (Soil Conservation Service 1972).

VEGETATION

Krauss (1977) described 3 general vegetation community types occurring along an elevation gradient at Bear Valley, each differing in slope, aspect, elevation and, subsequently, temperature and moisture. On drier sites (8-10 inches) at lower elevations and usually on south aspects, western juniper (*J. occidentalis*)-bitterbrush (*Purshia tridentata*)-bunch grass communities are supported. At intermediate elevations, ponderosa pine (*Pinus ponderosa*)-bitterbrush-sagebrush

(Artemisia spp.) forest communities are most common. On north and east aspects and/or at higher elevations, ponderosa pine merges with other species to form mixed conifer communities (Volland 1985).

Dominant tree species within the area include Douglas fir, ponderosa pine, white fir, sugar pine (Pinus lambertiana), incense cedar, and western juniper. Common shrubs include bitterbrush, snowbrush ceanothus (Ceanothus velutinus), golden chinkapin (Castanopsis chrysophylla), manzanita (Arctostaphylos spp.), mountain mahogany, and common snowberry (Symphoricarpos albus).

RIPARIAN AREAS

Riparian areas are uncommon on the Refuge. No perennial streams occur at Bear Valley. Four intermittent streams occur within the proposed project area. Management activities would not occur within 50 to 100 feet of these streams.

WILDLIFE

Bald Eagles

The Bear Valley area has long been recognized as an important winter communal roost site for bald eagles. Keister et al. (1987) reported that more than 500 bald eagles have wintered in the Klamath Basin, constituting one of the largest concentrations in the lower 48 states. In more recent years numbers have exceeded 1,000 eagles. Wintering bald eagles are usually present in the Basin between mid-October and April (Keister 1981). The roost at Bear Valley typically has the highest concentration of eagles during winter; as many as 64% of the entire wintering population in the Basin utilize this roost area (Dellasala et al. 1987). A summary of bald eagle flyout counts from the Bear Valley roost is presented in Table 3.

Bald eagle selection of specific habitats appears to be contingent upon several variables, including forest age and structure, distance to water, amount, type, and level of human disturbance, thermal regulation and energy conservation, and proximity to prey sources. Extensive eagle use at Bear Valley appears to be related not only to the availability of roost trees but also because of its proximity to major waterfowl migration routes (a key food source for wintering eagles) (Frenzel 1985), and its topographic position which offers favorable thermal conditions for roosting eagles (Keister and Anthony 1983, Keister et al. 1985).

Although the adaptive significance of communal roosting in birds is not well understood, it appears that communal roost sites used by eagles generally offer greater protection from weather than diurnal habitats (Keister et al. 1985). Communal roosts are often located in depressions or valleys or on leeward, northern slopes which are protected from wind (Stalmaster et al. 1985). These microclimates aid eagles with thermoregulation and energy conservation (Keister et al. 1985). Proximity to food sources is perhaps the most important

determinant of bald eagle communal roost area selection (Keister 1981, Keister and Anthony 1983, Isaacs and Anthony 1987). Selection of habitat for communal roosting occurs on at least three spatial scales, including a macrohabitat scale (roost area, generally near food resources), the roost stand (mature, multi-layered stands), and the individual tree (older, taller, dominant or co-dominant trees) (Dellasala et al. 1987).

Other Wildlife

A wide variety of forest-dwelling wildlife species occur at Bear Valley NWR (Appendix C, Tables 1 and 2).

The Bear Valley NWR was surveyed for Northern spotted owls during the field seasons of 1992 and 1993 according to standardized protocol employed by the USFWS (U.S. Fish and Wildlife Service 1992). No spotted owls have been heard or observed at Bear Valley (Weekley 1992, Weekley 1993). The Refuge is scheduled to be resurveyed during the breeding season in 1996.

FUELS

In general, mixed conifer stands are classified under fuel model #10 (timber litter and understory) (Anderson 1982) or the mixed conifer series described by Maxwell and Ward (1980). Fuel loadings in these stands are highly variable, but probably range between 6.8 and 56.3 tons/acre (Maxwell and Ward 1980). Other fuel model types on the Refuge include #2 (timber grass and understory) for ponderosa pine/grass communities, #5 (brush) and #6 (intermediate brush) for brush fields, #8 (closed timber litter) for more open mixed conifer and ponderosa pine stands, and #11 (light logging slash) for previously thinned mixed conifer and ponderosa pine stands (Anderson 1982). In treatment stands, the desired fuel loading is approximately 12 to 16 tons/acre.

CULTURAL RESOURCES

An Environmental Impact Assessment prepared for the original acquisition of Bear Valley identified no significant cultural resource sites within the proposed Refuge boundary (U.S. Fish and Wildlife Service 1978). An archaeological survey conducted in 1995 detected three historical sites within the proposed project area but no evidence of prehistoric activity was noted (US Fish and Wildlife Service 1995). Two of the sites are cabins and homestead sites. The third is an old railroad grade used for logging which still has the ties in place although the rails have been removed. Documentary research revealed that it is very likely that a branch of the Oregon Trail, which later became known as the Applegate Trail, passed through Bear Valley. The route along Bear Creek was apparently not the original route pioneered in 1846 but was highly used by later groups from 1846-1869. Due to intensive use of all roads in the area for logging earlier in this century, the on-the-ground survey could not determine with certainty if any of the numerous roads that traverse

the Refuge from southeast to northwest were once wagon roads. Therefore, although it is almost certain that the second edition of the Applegate Trail passed through the Refuge, no physical traces are extant.

RECREATION

The Bear Valley NWR was established, in part, to reduce potential human disturbance to roosting bald eagles (U.S. Fish and Wildlife Service 1978). Recreational opportunities on the Refuge are few; hiking, bird-watching, photography, most hunting, and motor vehicle use are all prohibited. Deer hunting with bow and arrow is permitted during the Oregon bow-hunt season.

Bald eagle "flyouts" generally occur each morning shortly after sunrise. These events are frequently observed outside the Refuge by both professional wildlife biologists and the general public. Each February, at the Klamath Basin Bald Eagle Conference held in Klamath Falls, field trips are scheduled to observe the eagle flyouts at Bear Valley. An observation station for wildlife viewers has been proposed in past years, and may be constructed during the project period, however, this project will have no bearing on the alternative selected for habitat improvement.

LOCAL ECONOMY

Wood products, agriculture, and tourism are the largest sources of income in Klamath County. Klamath county is a major timber producer which usually ranks in the top six counties in Oregon in timber production. 75% of the land area in the county is forested and lumber and wood products will remain the county's dominant industry for the foreseeable future. However, the role of the timber industry in the local economy is changing from output of milled boards to production of plywood and timber remanufacturing (Oregon Employment Department, 1993). One of the two remaining sawmills in Klamath Falls closed recently, leaving four large sawmill operations in Klamath County. Saw timber from Bear Valley is likely to be processed in the immediate area but wood chips produced from harvesting actions are more likely to be taken to facilities in Medford or Eugene. A number of recent timber sales on the Winema National Forest have wound up going to mills on the west side of the Cascade mountains rather than being milled in the immediate area. (Mike Mahan, Oregon Employment Department, pers. commun.)

Principal agricultural crops in the Klamath basin are alfalfa, barley, oats, potatoes, and sugar beets while beef cattle are important livestock. Most of the croplands in this area are dependent on irrigation.

FINAL BEAR VALLEY ENVIRONMENTAL ASSESSMENT

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

Alternative 1 - No Action

Description

Habitat improvement, including prescribed fire and thinning, would not be implemented under this alternative.

Issues:

Forest Health

As stand densities continue to increase, forest health may decline. Natural successional processes, which have already altered forest succession and fire frequency, will likely yield increased tree mortality associated with overstocking and insect and disease epidemics.

Maintain Existing Bald Eagle Roosting Habitat

Without management or provision for natural disturbance, the Refuge will likely continue to provide eagle roosting habitat for several years. Eventually, over the next several hundred years in the absence of management or significant natural perturbations, each subroost at the Refuge will likely progress toward a climax mixed-conifer forest dominated by white fir, thus deteriorating eagle roosting habitat (DellaSala et al. 1987).

Providing for Replacement Roost Trees

Dellasala et al. (1987) estimated that the current size-age structure of Douglas-fir and ponderosa pine in Bear Valley is adequate to supply replacement roost trees for at least the next hundred years even when high rates of mortality are assumed. These densities are satisfactory for the roost as a whole but portions of individual subroosts may fall below the targets. Subroosts 3 and 4 are already considered to be suboptimal due to overabundance of white fir and adequate densities of preferred roosting trees will continue to decline.

Increase Desired Roost Tree Species/Thin White Fir

This alternative will do nothing to increase desired roost tree species (ponderosa pine and Douglas-fir) nor will it reduce white fir densities. White fir will continue to increase at the expense of preferred roost tree species.

Eagle Response

Eagle response to this plan would have to be monitored for many years to find out whether the gradual successional processes are affecting the suitability of the habitat. It takes 125 to 150 years to produce a Douglas-fir tree with height and crown characteristics favorable for roosting. If monitoring shows a negative response by eagles to successional processes it will likewise take many years for an alternative improvement plan to reverse the trend.

Reintroducing Fire

Refuge fire personnel would attempt to suppress all wildfires occurring on the Refuge to maintain the status quo. This alternative amounts to a fire exclusion policy with no provisions to return to a fire regime that has historically been the norm for the area.

Increased Susceptibility to Wildfire

Fuel loadings and ladder-fuel arrangements will increase under this alternative, increasing the potential for catastrophic, stand-replacement wildfires. Previous fire suppression in this area has converted many stands from fire-resistant, open-grown ponderosa pine to relatively dense stands of fire-intolerant white fir, Douglas-fir, and incense cedar. This factor is the greatest immediate threat to roosting habitat under the No Action option.

Safety of Fire Suppression Forces

If a fire starts in Bear Valley or approaches the Refuge from surrounding lands on a typical hot, dry summer day, current fuel loadings are so high that fire intensity is likely to prohibit effective fire suppression. The extreme fire behavior that would be encountered, coupled with the limited access routes within the Refuge, would dictate extremely conservative suppression tactics in the interests of personnel safety. These tactics, such as construction of indirect fire lines, are likely to lead to the loss of large amounts of the roost sites that the Refuge was created to protect. This situation will continue to get worse with time.

Public Safety

The USFWS may be considered liable if a destructive fire started on Refuge land and spread to adjacent private land. It might be construed that, since USFWS knew that there was a potential hazard from wildfire and did nothing about the forest health in Bear Valley, the Service would be liable for the consequences.

Air Quality

There would be no effect on air quality under this course of action

except in the event of a wildfire occurring in the Refuge. In that case, the smoke produced is likely to be more than that released by prescribed burning and the location and extent of problems it may create is unknown. Since wildfires are not currently subject to Air Quality regulations there would be no ramifications to the USFWS from regulatory authorities. Safety problems caused by the smoke, such as reduced visibility on roads, would be the responsibility of law enforcement agencies with jurisdiction for the affected area. Complaints and political pressure may be directed at the Service because of smoke produced by a wildfire.

Costs

This alternative would not cost the USFWS any additional money. Costs incurred in suppressing wildfires will be paid for out of national fire suppression accounts.

Tax Base/Revenue Sharing with the County

Revenue Sharing with Klamath County will not change.

Local Employment

There would be no direct effect on local employment.

Potentially Controversial Issues

This proposal is not likely to be controversial to members of the public but the effectiveness of this option as a management tool is likely to be questioned by those knowledgeable of natural fire regimes and ecosystem processes. If a catastrophic wildfire burned much of the bald eagle habitat there would probably be public scrutiny as to why this alternative was selected over another.

Alternative 2 - Prescribed Fire

Description

Prescribed Fire would be used by itself to manage fuel loading and tree stocking densities. Some manual fuels treatment would be necessary if there is to be any chance of success.

Issues:

Forest Health

If large trees are not burned in prescribed fires they may or may not be healthier. Fire would lower the stocking density resulting in less stress due to less competition for water and other resources. Reduced stress allows the trees to resist disease and insects better. However, fires which are too hot may damage bark,

tree crowns, or roots, causing even more stress to trees and increasing potential forest health problems.

Maintain Existing Bald Eagle Roosting Habitat

Use of prescribed fire alone would be a risk to the very trees it is meant to preserve. A fire intended to consume materials on the ground may easily spread to the crowns of the trees. Individual roost trees may be consumed or killed even under ideal burning conditions, but present conditions for prescribed fire are much less than ideal. If a prescribed burn gets out of control it is possible that entire stands of roost trees could be destroyed.

Providing for Replacement Roost Trees

Prescribed fire in itself would not provide for replacement roost trees. Survival through the initial prescribed burns of the smaller diameter ponderosa pine and Douglas-fir trees that will reach roost tree size in 75-150 years would be by chance, dependent upon the type and arrangement of surrounding vegetation. Once prescribed burning has been initiated, continuing burn cycles will promote preferred roost tree species since they are more tolerant of fire than white fir. Implementation of prescribed burning during periods when there is a maximum seed crop of ponderosa pine and Douglas-fir available might help to supply adequate seedlings for replacement.

Increase Desired Roost Tree Species/Thin White Fir

Initially, fire would not thin white fir but would probably consume much of it. In the process, it would also consume any other species nearby as the fire is carried into the crowns by ladder-type fuels of the white fir branches.

Eagle Response

If prescribed fires under present conditions burn many of the roost trees eagle response is unknown.

Reintroducing Fire

This alternative would meet the goal of reintroducing fire to Bear Valley, however, due to the heavy fuel loadings and current potential for severe burning conditions, the loss of preferred species would be greater than if alternatives 3, 4, or 5 were implemented. In addition, only a small part of the Refuge lends itself to prescribed fire due to the heavy fuel loadings, access, safety issues, and the potential loss of preferred species.

Increased Susceptibility to Wildfire

Prescribed burning under controlled conditions would decrease heavy fuel loading and reduce (although not eliminate) the probability of

catastrophic wildfires, but the needed controlled conditions are not possible with the current fuel situation. In addition, the use of prescribed fire as a habitat improvement tool would take a long time to have an effect, which would not reduce the possibility of catastrophic wildfires occurring in areas waiting to be treated.

Safety of Fire Suppression Forces and Public Safety

Safety of suppression forces and public safety from wildfire would generally be improved as heavy fuel loadings are reduced by prescribed fires; areas that have burned may serve as barriers to slow the spread of wildfires. However, the hazards to prescribed fire personnel from the prescribed fires themselves will be greater than the prescribed fire component of alternatives 3, 4, or 5 due to the greater concentrations of fuels and higher risk of escape. Potential liability of the USFWS for a wildfire that escapes Refuge boundary would be reduced but not eliminated. Potential liability of the Service for a prescribed fire that escapes would increase.

Air Quality

Air Quality concerns would be created by prescribed burning. This alternative would create the most smoke since fuel loadings are higher than alternatives 3, 4, or 5. Safety problems caused by the smoke, such as reduced visibility on roads, would be the responsibility of the USFWS. Complaints and political pressure may be directed at the Service because of smoke produced by prescribed burning.

Costs

Costs for implementing a prescribed fire program would be significant and would need to come out of the Refuge's annual budget. Costs for burn preparation work and implementation would be significant. Upgrading roads in the Refuge would be an additional cost for the Refuge.

Tax Base/Revenue Sharing with the County

Habitat improvement by prescribed burning would not affect the Refuge tax base or revenue sharing with Klamath county.

Local employment

Local employment is not likely to be affected unless fuels pre-treatment or burning is contracted locally.

Potentially Controversial Issues

This proposal is more likely to be controversial to members of the public. The smoke produce by prescribed burning operations is likely to be highly visible and any adverse effects may heighten

publicity over the action. Since the timber salvage logging sales are currently a hot topic of debate, especially in a area where many people have traditionally relied on the forest products industry for their income, some people may become upset if merchantable timber is being burned purposely by the Federal government when it could be put to economic use and achieve virtually the same result. A limited number of people are likely to have sufficient knowledge of prescribed burn operations and fire effects to question the effectiveness of this option as a management tool.

Alternative 3 - Silvicultural Management and Fire I - Preferred

Description

This alternative would use an adaptive management approach to thin the forest stands over a period of 10-15 years. A series of commercial thinning sales will be used to carry out silvicultural treatments. Two different prescriptions will be used initially in the first treatment area. After the first timber sale is completed, a period of monitoring for 1-2 years will take place. An IDT will evaluate the results of the first thinning operation and monitoring data to give recommendations on the how the next treatment unit should be carried out. The plan may be adapted to use improved methods or prescriptions which reflect increased knowledge of the results of thinning activities.

Ground-based timber harvesting operations would take place over both lower subroosts and the parts of the upper subroosts which are not too steep. Some areas outside of the subroosts would be treated as well. The series of sales spread out over a number of years gives margin for errors if eagles react unfavorably. Following commercial thinning operations, prescribed fire would be implemented to return the forests to a natural fire regime.

The first year's thinning activities will test two different silvicultural prescriptions. Non-subroost areas will be thinned to a timber stand density that was originally recommended by DellaSala et al (1987) to maximize individual tree size, open-branched characteristics, and maximum number of trees per acre. The general prescription from that study was modified into a detailed, site-specific prescription by a BLM silviculturist who also incorporated local experience of the BLM, the Winema National Forest, and Weyerhaeuser Co. at managing bald eagle habitat. This prescription will be referred to as "Prescription A". In general, Prescription A will target a 20 foot spacing of all desired tree species in all size categories, leaving an average of 121 trees/acre in treated stands (Appendix A).

A concern about prescription A is that this average spacing will result in an even-spaced "plantation" effect. However, the average spacing between trees is only a guide obtained mathematically. Trees

prescriptions may need to be altered to obtain better results in known subroost areas. At any rate, due to differences in stand characteristics between subroosts and to changes that have occurred since the 1980s, a stand exam will need to be done for each treatment area before additional thinning operations are undertaken. From this, a detailed, site-specific prescription and marking guide can be developed.

The Final EA has been changed to include a prescription which will not cut trees larger than 14" to find out which of two prescriptions is most suitable. It will emphasize that Prescriptions A and B are site specific to Treatment Area 1 and will not necessarily be imposed across the entire Bear Valley roost.

- The monitoring plan as proposed in the Draft EA was insufficient and vague in what will be done when. Several comments expresses frustration that proceeds from a commercial thinning sale couldn't be used to monitor the effects of the sale on bald eagles.

  The monitoring plan (Appendix B) was rewritten based on input from personnel at the Oregon Cooperative Wildlife Research Unit. This plan consists of specific activities and dates which are realistic given current budget, staffing, and workload at the Klamath Basin NWR Complex.

  Unfortunately for this project, a more elaborate monitoring plan cannot be developed and paid for with money taken received from a timber sale. Federal and USFWS regulations are specific in terms of how receipts from the sale of resources may be used. Only those activities directly related to the harvest of timber may be paid for with the proceeds of a timber sale at Bear Valley. Monitoring expenses must be paid for out of the normal Refuge operations accounts appropriated by congress.

- Forest health problems are overemphasized. The basis for these comments is that 1) The Klamath Basin of Oregon had recently experienced eight years of drought but we are still not seeing mortality problems in the timber stands, and 2) The mortality that has occurred could actually be beneficial in reducing the stocking densities. The justification for silvicultural treatments should be based on an unquestioned wildfire problem.

  This project is primarily looking towards future potential forest health problems rather than waiting for them to develop, then facing a lag time due to workload constraints and NEPA considerations before being able to deal with them. The preferred alternative identified in this document is projected to take 10-15 years in a controlled approach. If a forest health problem does surface, the USFWS may not have the luxury of a prolonged, controlled attack on the problem in a manner which will minimize impact on the roost habitat.

  The intent of improving the forest health at Bear Valley is to

forestall potential massive mortality problems that have taken place in similar forests in the vicinity (C. Sokol, Weyerhaeuser, pers. commun., Phil Jahns, USFS, pers. commun., Bill Johnson, BLM, pers. commun.) The underlying cause of these forest health problems is overstocking of timber stands and the increased competition for limited water and nutrient resources as is briefly discussed in Chapter 1, Section C. In the 1987 report (DellaSala et al. 1987), the effect of increasing competition for water and nutrients as the density of all tree species increases was not well addressed. All forest health experts consulted in the planning stages of this project were extremely concerned about forest health as defined by the current timber density compared to carrying capacity of the land.

One of the recommendations of the 1987 report was that a forester should examine the roost every two to three years to identify any insect or disease outbreaks (DellaSala et al. 1987). Several foresters have examined Bear Valley recently and have affirmed that the timber stands there are overstocked in most areas and validated the concern that major insect or disease outbreaks are possible in the near future. Their recommendations were included in the development of alternatives for this project.

A quantitative study of actual mortality has not taken place. A cursory risk assessment was performed to identify priority areas for treatment (Andy Eglitis, USFS, unpubl. data). An entomologist and an ecologist examined the areas which had previously been identified as feasible treatment areas in the near future. This assessment made a comparison of current stocking levels to guidelines which show the stocking density at which tree mortality begins to occur based on the plant community association for the site. Stands stocked above that level will be likely to experience tree mortality in the near future due to density-dependent agents such as bark beetles. The recommendations of concluded that all areas are overstocked, and all are in need treatment to reduce stocking densities.

Visual inspection of the Bear Valley subroosts, especially the upper elevation roosts, by people familiar with conditions in the mid-1980s indicates that considerable mortality has taken place, especially in white fir, which is less tolerant of drought stress than other species. An entomologist who examined the Refuge observed considerable evidence of recent white fir mortality as a result of attacks by the fir engraver (Andy Eglitis, USFS, unpubl. data.) The intent of the public tour of Bear Valley on November 4, 1995 was for interested individuals to be able to see for themselves the extent of the mortality that is occurring at the Refuge.

It is true that the mortality that is occurring is eliminating those individual trees from competition with other trees, however, as white fir dies it will tend to re-establish itself rather than be replaced by more desirable species. Most of these trees are in smaller size classes and the snags created are of no use as roost

trees. Dead trees, both standing and on the ground, further contribute to an already high concentration of available fuels. In eastern Oregon, dead and down woody material has an extremely slow rate of decay and will remain a fuel for many years (Gene Rogers, USFS, pers. commun.) For this reason, until fuel loading is reduced to a point where prescribed fire alone can be used to maintain the stands, mortality that is occurring is adding to the wildfire problem.

As a result of these comments, some portions of the Final EA (e.g. the objectives and issues) were changed to reflect the consensus agreement that the major emphasis on silvicultural treatment at Bear Valley is to reduce the risk of a catastrophic fire within the roost. Other parts will be changed to reflect the interpretation of forest health problems as a highly stocked and overstocked condition which is likely to lead to mortality from insects and disease.

As a result of other comments received, several other small but significant changes were made to the Final EA, including clarifying how roost trees will be identified and developing a better mitigation plan for the problem of carrying out management activities in the vicinity of active bald eagle nests.

E. Pertinent Laws, Executive Orders, and Regulations

50 CFR Ch.1 (10-1-94 Edition) Subpart A 29.1 Use of Natural Resources. This regulation states that public or private economic use of the natural resources of a wildlife refuge may be authorized where the use may contribute to or is related to the administration of the area. Economic use may be authorized when the activity, including removing timber, will not be incompatible with the purposes for which the refuge was established. Permits for economic use will contain terms and conditions that are determined necessary for the proper administration of the resources.

As stated above, selective logging in the Bear Valley area was specifically mentioned in the original Environmental Impact Assessment as a forestry management practice to preserve the timber stand characteristics of the site (U.S. Fish and Wildlife Service, 1978). Only logging that was incompatible with the eagle winter habitat needs or which detracts from timber stand conditions was intended to be prohibited.

50 CFR Ch.1 (10-1-94 Edition) Subpart A 29.5 Fees. This regulation states that Fees and charges for the sale of products taken from refuge areas shall be set at a rate commensurate with fees and charges for similar privileges and products made by private land owners in the vicinity in accordance with their local value

It is anticipated that any commercial thinning operations or sale of timber products from the Bear Valley would be administered under cooperative agreement with the Bureau of Land Management. The BLM has

forestry specialists with experience in timber sales - an area which local USFWS personnel have little experience in. This will help ensure that logging operations run smoothly and that fees charged will be comparable to others in the vicinity.

Endangered Species Act of 1973, as amended. This act provides broad protection to threatened and endangered species such as bald eagles. Section 7 of this act requires consultation with the USFWS if actions by a Federal agency may jeopardize the habitat of an endangered species.

FINAL BEAR VALLEY ENVIRONMENTAL ASSESSMENT

Chapter 6

CONCLUSIONS AND RECOMMENDATIONS

It is anticipated that thinning the timber stands at Bear Valley NWR followed by prescribed burning will reduce potential forest health problems and decrease the chance that this important habitat will be lost to wildfire. The technique of "thinning from below" will maintain the upper level canopy while removing the understory trees that are the biggest threats to the current conditions. Management activities are to be accomplished through commercial timber sales - a cost-effective means of carrying out the silvicultural treatments which will not detract from the other missions of the Klamath Basin NWR Complex.

Monitoring activities are sufficient to determine the effect of habitat improvement actions on use of the Bear Valley roost by bald eagles. The multi-year plan for carrying out this action will mitigate the possibility that an ineffective treatment will adversely affect a substantial portion of the roost. The adaptive management approach to be used allows the flexibility to improve on the plan based on initial experience with silvicultural treatments.

While the goal of this habitat improvement plan is specifically to preserve and enhance winter communal roosting habitat for bald eagles, the needs of other wildlife species have been considered and will be accommodated as much as possible. The needs of wildlife have been balanced with the needs of people, especially issues of wildfire and prescribed fire safety concerns, in the development of this plan.

Based on the analysis contained in this document, I find that implementation of the proposed action:

__X__ Is compatible with the major purposes for which the area was established.

_____ Is not compatible with the major purposes for which the area was established.

_____ Would constitute an action significantly affecting the quality of the human environment and, therefore, recommend an EIS be prepared. (Forward EA to RO for review.)

__X__ Would not constitute an action significantly affecting the quality of the human environment and therefore, recommend a Finding of No Significant Impact (FONSI) be prepared.

Thomas W. Stewart 6-14-96

Project Leader Date

_____ _____

Associate Manager Date

LITERATURE CITED

Alexander, R.R. and C.B. Edminster. 1980. Management of ponderosa pine in even-aged stands in the southwest. USDA For. Serv. Res. Paper RM-225. 11 pp.

_____, and _____. 1981. Management of ponderosa pine in even-aged stands in the Black Hills. USDA For. Serv. Res. Paper RM-228. 10 pp.

Anderson, H.E. 1982. Aids to determining fuel models for estimating fire behavior. USDA For. Serv. Gen Tech. Rept. INT-122. 22 pp.

Anderson, R.J. 1985. Bald eagles and forest management. Forest. Chron. 4:189-193.

Anderson, S.H. and C.T. Patterson. 1988. Characteristics of bald eagle winter roosts in Wyoming. Prairie Nat. 20:147-152.

Andrew, J.M. and J.A. Mosher. 1982. Bald eagle nest site selection and nesting habitat in Maryland. J. Wildl. Manage. 46:383-390.

Anthony, R.G., R.L. Knight, G.T. Allen, B.R. McClelland, and J.I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. Trans. North Am. Wildl. and Nat. Resour. Conf. 47:332-342.

_____, and F.B. Isaacs. 1989. Characteristics of bald eagle nest sites in Oregon. J. Wildl. Manage. 53:148-159.

Arnett, E.B. 1993. Bald eagle winter roost habitat management at Bear Valley National Wildlife Refuge in southcentral Oregon - biological justification and project summary. U.S. Fish and Wildl. Serv., Klamath Basin NWR's, Tulelake, CA. Unpubl. Rept. 12 pp.

Bailey, R.G. 1980. Description of the ecoregions of the United States. USDA Forest Service Miscellaneous Publication No. 1391.

_____, and L.F. Roth. 1985. Response of dwarf mistletoe-infested ponderosa pine to thinning: 1. Sapling growth. USDA For. Serv. Res. Paper PNW-322. 15 pp.

Barrows, C. 1981. Roost selection by spotted owls and adaptation to heat stress. Condor 83:302-309.

Gutierrez, R.J., D.M. Soils, and C. Sisco. 1984. Habitat ecology of the spotted owl in northwestern California: implications for management. Pages 363-368 in Proc. Soc. Am. For.

Gutierrez, R.J., J.P. Ward, A.B. Franklin, W. LaHaye, and V. Meretsky. 1985. Dispersal ecology of juvenile northern spotted owls (Strix occidentalis caurina) in northwestern California. Final rep. On Coop Agreement PNW-82-226, Portland, Oreg. 48pp.

Hawksworth, F.G. 1978. Intermediate cuttings in mistletoe-infested lodgepole pine and southwestern ponderosa pine stands. Pages 86-92 in R.F. Scharpf and J.R. Parmeter, tech. coord. Proc. Symp. on dwarf mistletoe control through forest management. USDA For. Serv. Gen. Tech. Rept. PSW-31. 190 pp.

Hopkins, W.E. 1979. Plant associations of south Chiloquin and Klamath Ranger Districts - Winema National Forest. USDA For. Serv. Pac. N.W. Region, R6-ECOL-79-005. 96 pp.

Isaacs, F.B. and R.G. Anthony. 1987. Abundance, foraging, and roosting of bald eagles wintering in the Harney Basin, Oregon. Northwest Sci. 61:114-121.

_____ and _____. 1993. Bald eagle nest locations and history of use in Oregon, 1971 through 1993. Oregon Coop. Wildl. Res. Unit, Oregon State Univ., Corvallis. 14 pp, 5 tables, 1 figure.

Jensen, K.C. 1988. Nest site selection by bald eagles in Montana. M.S. Thesis, Montana State Univ., Bozeman. 56 pp.

Keister, G.P. 1981. Characteristics of winter roosts and populations of bald eagles in the Klamath Basin. M.S. Thesis, Oregon State Univ., Corvallis. 82 pp.

_____ and R.G. Anthony. 1983. Characteristics of bald eagle communal roosts in the Klamath Basin, Oregon and California. J. Wildl. Manage. 47:1072-1079.

_____, _____, and H.R. Holbo. 1985. A model of energy consumption in bald eagles: an evaluation of night communal roosting. Wilson Bull. 97:148-160.

_____, _____, and E.J. O'Neill. 1987. Use of communal roosts and foraging areas by bald eagles wintering in the Klamath Basin. J. Wildl. Manage. 51:415-420.

Brown, E.R. (ed.) 1985. Management of wildlife and fish habitats in forests of western Oregon and Washington. U.S. Forest Service, Publication No. R6-F&WL-192-1985, PNW Region, Portland, OR.

Burke, M. 1983. Bald eagle nesting habitat improved with silvicultural manipulation in northeastern California. Pages 101-105 in D.M. Bird, N.R. Seymour, and J.M. Gerrard, eds. Biology and management of bald eagles and ospreys. MacDonald Raptor Res. Center, McGill Univ., Montreal, Quebec.

DellaSala, D.A., R.G. Anthony, and T.A. Spies. 1987. A habitat management plan for bald eagle (Haliaeetus leucocephalus) communal roost sites at the Bear Valley National Wildlife Refuge, Oregon. Oregon Coop. Wildl. Res. Unit, Oregon State Univ., unpubl. rept. 77 pp.

Emmingham, W.H., R. Holthausen, and M. Vomocil. 1992. Silvicultural systems and stand management. Pages 123-142 in H.C. Black, Tech. Ed., Silvicultural approaches to animal damage management in Pacific Northwest Forests. USDA For. Serv. Gen. Tech. Rept. PNW-GTR-287. 422 pp.

Fiddler, G.O., D.R. Hart, T.A. Fiddler, and P.M. McDonald. 1989. Thinning decreases mortality and increases growth of ponderosa pine in northeastern California. USDA For. Serv. Res. Paper PSW-194. 7 pp.

Forsman, E.D., E.C. Meslow, and H.M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildl. Monogr. 87:1-64.

Franklin, J.F. and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. USDA For. Serv. Gen. Tech. Rept. PNW-8. 417 pp.

Frenzel, R.W. 1985. Environmental contaminants and ecology of bald eagles in southcentral Oregon. Ph.D. Diss., Oregon State Univ., Corvallis. 143 pp.

Gibson, K.E. 1989. Partial cutting (sanitation thinning) to reduce mountain pine beetle-caused mortality. Pages 45-47 in G.D. Amman, compiler. Proc. Symp. on the management of lodgepole pine to minimize losses to the mountain pine beetle. USDA For. Serv. Gen. Tech. Rept. INT-262. 119 pp.

Krauss, G.D. 1977. A report on the 1976-1977 Klamath Basin bald eagle winter use area investigation. USDA For. Serv., Klamath Nat. For. 68 pp.

Lundquist, J.E. 1993. Large scale spatial patterns of conifer diseases in the Bighorn Mountains, Wyoming. USDA For. Serv. Res. Note RM-523. 8 pp.

Marsden, M.A., C.G. Shaw III, and M. Morrison. 1993. Simulation of management options for stands of southwestern ponderosa pine attacked by armillaria root disease and dwarf mistletoe. USDA For. Serv. Res. Paper RM-308. 5 pp.

Maxwell, W.G. and F.R. Ward. 1980. Photo series for quantifying natural forest residues in common vegetation types of the Pacific Northwest. USDA For. Serv. Gen. Tech. Rept. PNW-105. 230 pp.

McCambridge, W.F. and R.E. Stevens. 1982. Effectiveness of thinning ponderosa pine stands in reducing mountain pine beetle-caused tree losses in the Black Hills - preliminary observations. USDA For. Serv. Res. Note RM-414. 3 pp.

McNeil, R.C. 1987. Vegetation and fire history of ponderosa pine-white fir forest in Crater Lake National Park. M.S. Thesis, Oregon State University, Corvallis. 171 pp.

Means, J.E. 1982. Developmental history of dry coniferous forests in the western Cascades. In J.E. Means, ed. Proc. of the Symp. on Forest Succession and Stand Development Research in the Northwest. Oregon State Univ., Corvallis.

Meslow, E.C., C. Maser, and J. Verner. 1981. Old growth forests as wildlife habitat. Trans. N. Amer. Wildl. Nat. Resour. Conf. 46:329-335.

Meyer, J.S., L.L. Irwin, and M.S. Boyce. 1990. Unpubl. Influence of habitat fragmentation on spotted owl site selection, site occupancy, and reproduction status in western Oregon. 46 pp.

Miller, G.S. 1989. Dispersal of juvenile northern spotted owls in western Oregon. M.S. Thesis. Oregon State Univ. Corvallis. 139pp.

Oliver, W.W. and C.B. Edminster. 1988. Growth of ponderosa pine thinned to different stocking levels in the western United States. Pages 153-159 in W.C. Schmidt, comp. Proceedings - future forests of the mountain west: a stand culture symposium. USDA For. Serv. Gen. Tech. Rept. INT-243.

Opp, R.R. 1980. The status of the bald eagle in Oregon - 1980. Pages 35-41 in R.L. Knight, G.T. Allen, M.V. Stalmaster, and C.W. Servheen, eds. Proc. of the Washington Bald Eagle Symp., 14-15 June 1980, Seattle, WA.

Oregon Employment Department. 1993. Regional Economic Profile - Klamath and Lake Counties. State of Oregon Employment Department, Research and Analysis, Salem OR.

Paton, P.W.C., C. Zabel, B. Binham, H. Sakai, and C. Ogan. 1990. Unpubl. Examination of home range size and habitat use of the spotted owl in the Klamath Province. Progress report covering the spotted owl in the Klamath Province. Progress report covering the period from spring 1987-December 1989. PSW Forest and Range Exp. Stn., Arcata. 15pp.

Patterson, S. 1992. Douglas-fir beetle: dealing with an epidemic. Pages 73-76 in D. Murphy, Comp., Getting to the future through silviculture - workshop proceedings. USDA For. Serv. Gen. Tech. Rept. INT-291. 97 pp.

Richards, D.L. and M. Burke. 1985. Improving bald eagle habitat with silvicultural manipulation in northeastern California. Pages 277-283 in Proc. of the Nat. Silvicul. Workshop: successes in silviculture. Rapid City, South Dakota, May 13-16.

Rosenberg, K.V., and M.G. Raphael. 1986. Effects of forest fragmentation on vertebrates in Douglas-fir forests. Pages 263-272 in J. Verner, M.L. Morrison, and C.J. Ralph, eds. Modeling habitat relationships of terrestrial vertebrates. Univ. Wisconsin Press.

Rothermel, R.C. 1983. How to predict the spread and intensity of forest and range fires. USDA For Serv. Gen. Tech. Rept. INT-143. 161 pp.

Sartwell, C. and R.E. Stevens. 1975. Mountain pine beetle in ponderosa pine: prospects for silvicultural control in second growth stands. J. Forestry 73:136-140.

Scharpf, R.F. 1969. Dwarf mistletoe on red fir - infection and control in understory stands. USDA For. Serv. Res. Paper PSW-50. 8 pp.

_____. 1978. Control of dwarf mistletoe on true firs in the west. Pages 117-123 in R.F. Scharpf and J.R. Parmeter, tech. coord. Proc. Symp. on dwarf mistletoe control through forest management. USDA For. Serv. Gen. Tech. Rept. PSW-31. 190 pp.

Schmid, J.M., S.A. Mata, and C.B. Edminster. 1991. Periodic annual increment in basal area and diameter growth in partial cut stands of ponderosa pine. USDA For. Serv. Res Note RM-509. 3 pp.

_____ and S.A. Mata. 1992. Stand density and mountain pine beetle-caused tree mortality in ponderosa pine stands. USDA For. Serv. Res Note RM-515. 4 pp.

Spies, T.A, and Franklin. In Press. The structure of natural, young, mature, and old-growth forests in Washington and Oregon. In L.F Ruggiero, K.B. Aubry, A.B. Carey, M.H. Huff. Tech. Coords. Wildlife and vegetation of unmanaged Douglas-fir forests. U.S. For. Serv. Gen. Tech. Rep.

Soil Conservation Service. 1972. Soil interpretations for Oregon. USDA Soil Conserv. Serv.

Stalmaster, M.V., R.L. Knight, B.L. Holder, and R.J. Anderson. 1985. Bald eagles. Pages 269-290 in E.R. Brown, tech. ed. Management of wildlife and fish habitats in forests of western Oregon and Washington: part 1 - chapter narratives. USDA For. Serv., Pacific Northwest Region. 332 pp.

Thomas, J.W., and E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A Conservation Strategy for the northern spotted owl. Report of the Interagency Committee to address the conservation of the northern spotted owl. U.S. Department of Agriculture, Forest Service, and the U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management and National Park Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 1978. Acquisition of the Bear Valley National Wildlife Refuge, Klamath County, Oregon. Environmental Impact Statement. USDI Fish and Wildl. Serv., Portland, OR. 34 pp.

_____. 1986. Recovery Plan for the Pacific Bald Eagle. U.S. Fish and Wildlife Service, Portland, Oregon. 160pp.

_____. 1992. Guidelines for surveying proposed management activities that may impact northern spotted owls. USDI Fish and Wildl. Serv., Portland, OR.

_____. 1996. Cultural Resource Inventory at the Bear Valley National Wildlife Refuge, Klamath County, Oregon. U. S. Fish and Wildlife Service, Sherwood, OR. 30 pp.

U.S. Forest Service. 1990. Winema National Forest land and resource management plan. USDA For. Serv., Pacific Northwest Region, Winema National Forest, Klamath Falls, Oregon. 374 pp.

_____. 1991. Stand examination program: field procedures guide. USDA For. Serv., Pacific Northwest Region, Portland, Oregon.

U.S. Forest Service and U.S. Bureau of Land Management. Final Supplemental Environmental Impact Statement on Management of Habitat for Late Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. Feb. 1994.

U.S. Forest Service and U.S. Bureau of Land Management. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. Standards and Guidelines for Management of Habitat for Late Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. April 1994.

Volland, L.A. 1985. Plant associations of the central Oregon pumice zone. USDA For. Serv. Pac. N.W. Region, R6-ECOL-104-1985. 138 pp.

Weekley, F.L. 1992. 1992 Spotted owl survey - Bear Valley National Wildlife Refuge, Oregon. Unpubl. report for USDI Fish and Wildl. Serv. 9 pp.

_____. 1993. 1993 Spotted owl survey - Bear Valley National Wildlife Refuge, Oregon. USDA For. Serv., Modoc National Forest, Tulelake, CA, unpubl. report for USDI Fish and Wildl. Serv. 7 pp.

Weyerhaeuser Company. 1992. Doak Mountain management plan for forest health and eagle habitat. Weyerhaeuser Company, Tacoma, WA. 53 pp.

Wood, P.B., T.C. Edwards Jr., and M.W. Collopy. 1989. Characteristics of bald eagle nesting habitat in Florida. J. Wildl. Manage. 53:441-449.

APPENDIX A

SILVICULTURAL PRESCRIPTIONS

Abiotic Data:

Aspects are predominantly northeast. Slopes are gentle to moderate generally ranging between 5-30%. Elevation ranges between 4,500 and 4,900 feet in subroosts 1 and 2, and between 4,600 and 5,800 in subroosts 3 and 4. Soil is generally a Woodcock stony loam.

Biotic Data:

The plant association in lower elevation (< 4,700) ponderosa pine communities most closely resembles the ponderosa pine/bitterbrush-snowbrush/sedge type (CPS-312) described by Volland (1985). At higher elevations, the plant association resembles mixed conifer/snowbrush-bearberry types (CWC-215) described by Hopkins (1979). Dominant species are Douglas-fir, ponderosa pine, and white fir. An incense cedar component is also present in this type.

Since the timber stand composition changes significantly between the lower and upper elevations of the Refuge, the actual prescriptions for each treatment unit will be adjusted based on a detailed timber stand examination of that unit. Each unit will have a detailed silvicultural prescription written to meet the objectives listed below based on the conditions of that unit.

Prescriptions A and B have been developed specifically for Treatment Area 1 as shown in the preferred Alternative 3, figure 3c. Specific areas to be treated with each prescription are shown in figure 4, Appendix B. Prescriptions for Alternatives 4 and 5 would probably be similar.

Objectives common to both prescriptions are to:

- Encourage the growth of existing and potential future bald eagle roost trees.
- Thin the understory to reduce stocking densities to levels that are sustainable for the site.
- Reduce fuel concentration and arrangement to decrease the risk of a destructive wildfire.
- Assure that a continuous supply of trees suitable for roosting and nesting is available in future years.
- Accommodate the habitat needs of other wildlife species whenever possible.

Prescription A

In addition to the objectives listed above, specific silvicultural objectives are to:

- Produce large trees with crown characteristics preferred by eagles (open, heavy-branched crowns).

are first selected for leaving based on other characteristics than spacing. Since the trees have grown naturally, some of the leave trees with the desired characteristics will wind up being closer together and some farther apart; some areas currently have a low density of trees while other parts have a very high density. In the thinned areas as a whole, the goal is to have the number of trees per acre reduced to a certain number, thus an "average" spacing, however, in reality few trees will actually be this distance apart. The marking guidelines prepared by the BLM to be used by the on-the-ground timber sale markers even call for leaving occasional clumps of several larger trees specifically to create variations in the landscape.

A different silvicultural prescription will be used in treated areas within subroosts 2 and 3. Several comments received on the draft EA for this action expressed concern that the smallest trees eagles normally used for roosting are those at least 14" in diameter. Removal of trees larger than this may take away current roost trees or the next generation of roost trees. In this second prescription, no trees larger than 14" would be cut; only the smaller, understory trees would be thinned. This prescription will be referred to as "Prescription B".

By leaving all trees larger than 14", clumps of larger trees will be retained to a greater extent under Prescription B. Since the trees have grown in clumps naturally, this type of grouping may offer characteristics that eagles prefer, perhaps related to thermal cover or opportunities for social interaction. A new analysis of the data gathered in 1986 indicates that it is not only the characteristics of the roost tree itself that may be attractive to eagles but roost tree selection may also depend on the characteristics of the trees in the immediate vicinity surrounding it (D. Dellasala, World Wildlife Fund, unpubl. data).

Potential drawbacks to Prescription B are that the level of competition between the trees in a clump will remain a limiting factor to the health and potential growth of the trees. This may be especially true since the clumps of trees have not been thinned by frequent, low-intensity wildfires and may be denser than they would have been under natural fire regime conditions. The clumps of trees in the Refuge may also be growing in an unnatural fashion since the forest structure has been altered by previous logging practices.

Whether to thin clumps of trees, which is how ponderosa pines tend to grow, is a common dilemma when managing timber. Trees growing in a clump may be more susceptible to beetle attacks. If one tree in a clump is weak it may be attacked; beetles which make a successful attack send out a pheromone that attracts other beetles. The ensuing mass attack may cause the loss of all the other trees in the clump (Andy Eglitis, unpubl. data)

Other potential effects of Prescription B are that trees growing very close together may not develop the open-branched characteristics that open-grown trees would. Preferred roost tree species would not be

given preference in determining which trees to take or leave (other than in the smaller size classes). Under this prescription there is no allowance for the removal of large trees which may be affecting the health of other trees, e.g. a large, overstory tree infected with dwarf mistletoe over a healthy understory.

The prescription, boundaries, and time frames to be used on the second and subsequent sales will be determined by convening an IDT to examine the thinned area the summer after each thinning is done as described in Appendix B.

Issues:

Forest Health

Silvicultural manipulation has been recognized as a potential method for reducing tree loss to insects and disease. Commercial and non-commercial thinning has been shown to reduce various insect and disease associated mortality in ponderosa pine (Sartwell and Stevens 1975, McCambridge and Stevens 1982, Fiddler et al. 1989, Schmid and Mata 1992, Marsden et al. 1993), lodgepole pine (Hawksworth 1978, Gibson 1989), and true firs (Scharpf 1969, 1978, Patterson 1992).

Thinned stands also exhibit better growth rates when compared to unmanaged stands. Schmid et al. (1991) reported that mean diameter growth of ponderosa pine was inversely related to growing stock level in the Black Hills of South Dakota. They found that 5-year basal area and diameter growth in thinned stands were nearly double that of controls. Others have shown similar relationships between tree growth rates and stocking density (Alexander and Edminster 1980, 1981, Oliver and Edminster 1988, Fiddler et al. 1989). Barrett and Roth (1985) demonstrated that wide spacing after thinning ponderosa pine stands allowed for released trees to produce healthy crowns and acceptable growth rates, despite heavy dwarf-mistletoe infestation.

Maintain Existing Bald Eagle Roosting Habitat

This alternative is likely to maintain the existing large trees needed for bald eagle roosting habitat. Current roost trees and large trees will be left during thinning operations. With the reduction of fuel loading during the thinning process, there is less danger of heat from a prescribed fire damaging trunk, crowns, and root systems of remaining trees. However, prescribed burning under conditions of low soil moisture may lead to greater mortality of large trees if the soil heats up to the point that tree roots are damaged.

Mechanical harvesting methods, if done improperly, may also cause the loss of existing trees by compacting soil around remaining trees, damaging and killing roots. Compaction of soil may be lessened by use of certain types of harvesting equipment, using

designated skid trails, and by not using equipment when soil moisture is high.

Providing for Replacement Roost Trees

The silvicultural prescriptions (Appendix A) were specifically designed to provide replacement roost trees for several hundred years. If seedling and sapling densities do not meet the desired level, planting could occur. Implementation of prescribed burning during periods when there is a maximum seed crop of ponderosa pine and Douglas-fir available might be one way to ensure adequate seedlings for replacement.

Increase Desired Roost Tree Species/Thin White Fir

Desired roost tree species (ponderosa pine and Douglas-fir) should be increased. They will be given preference over other species when determining spacing during thinning operations. Since they are more resistant to fire, continued prescribed burning will promote their growth over white fir and other competing species.

White fir will be thinned in the treated areas. The silvicultural prescription calls for removal of white fir in preference to any other species. Untreated areas will retain their present dense stand characteristics.

Eagle Response

This alternative's biggest advantage is that it has built-in safeguards in case eagles react unfavorably to alteration of the current habitat. Planned silvicultural treatment will not cover all the subroosts at once. The planned breaks between timber sales allows an opportunity to alter or discontinue silvicultural manipulation based on earlier experience and results of monitoring.

Reintroducing Fire

Silvicultural and fuels treatments implemented during this project would reduce the intensity of fire under any given condition, allowing better control of prescribed fires and permitting future stand improvement by the use of fire.

Increased Susceptibility to Wildfire

The probability of catastrophic wildfire will be reduced as fuel loadings are reduced and continuity of fuels is broken up by thinning and burning. Any wildfires that do occur are more likely to stay on the ground, perhaps burning individual trees but not removing whole stands. Removal or treatment of thinning residues to reduce the fire hazard in treated units will be a stipulation of the logging contract. Crushing of invading underbrush by harvesting equipment may make burning more effective.

A drawback to this alternative's conservative time frame for carrying out treatment activities is that a fire may destroy some of the untreated subroosts in the 10-15 years it will take before the last subroost areas are treated. Nor is it planned to treat all of the subroost sites, consequently the fire protection benefits created by silvicultural treatment would not immediately be extended to all areas of concern. Even after treatment, some increase in fire danger may occur initially after thinning operations opens the canopy, exposing duff and fuels on the ground to increased drying and higher winds.

Safety of Fire Suppression Forces and Public Safety

Safety of suppression forces and public safety would be improved significantly as heavy fuel loadings are reduced by fire. Fire intensity is likely to be lower and barriers to spread will be created that will give suppression forces more options for controlling wildfires. Road improvement will allow easier access for equipment while thinning operations will make foot access easier and safer. Landings used for log decks may serve as turn-arounds, safety zones, and helicopter landing spots. Potential liability of the USFWS for a wildfire that escapes the Refuge boundary would be reduced but not eliminated. Potential liability of the Service for a prescribed fire that escapes would increase, but not as much as it would under Alternative 2.

Improving roads within the Refuge may encourage human trespass, even though the Refuge is almost completely closed to public entry, which may increase the risk of human-caused fires.

Air Quality

Air Quality concerns created by prescribed burning would have to be managed. Safety problems caused by the smoke, such as reduced visibility on roads, would be the responsibility of the USFWS. Complaints and political pressure may be directed at the Service because of smoke produced by prescribed burning.

Costs

A big advantage of treatment options is that the major costs of road improvement, monitoring the contract, and preparation for prescribed burning can be incorporated into the timber sale contract. However, the amount of land to be cut each year under this alternative (approximately 300 acres per year in each year that thinning is done) may be at the lower end of economic feasibility for logging contractors (M. Crockett, BLM, pers. commun.) This, coupled with the possible release to the market of extensive salvage logging areas under recently enacted legislation, may keep bid prices low and limit the amount of additional work that can be paid for as part of the contract.

Tax Base/Revenue Sharing with the County

Revenue sharing with Klamath County may increase during the course of commercial sales activity. Net receipts will depend on the bid price at the time the sale is auctioned.

Local employment

Local or regional employment may be assisted by commercial thinning alternatives such as this.

Potentially Controversial Issues

There is potential for controversy under any of the alternatives involving logging activities in Bear Valley. Since the USFWS is now planning to thin timber stands on the Refuge after condemning the land to prevent destruction of roost trees by improper logging, local citizens may see the proposal as hypocritical.

The Bear Valley was not acquired to prevent logging but to prevent forestry management practices that would adversely impact eagle habitat and/or use. The primary threat to eagle habitat at the time the Service acquired the Refuge was that taller trees used by eagles were about to be cut. A secondary consideration for acquiring the Refuge was that it would permit vegetation manipulation which would provide suitable perch trees for eagles in the future. Selective logging that is compatible with eagle winter habitat needs or improves timber stand conditions to the eagle's advantage was specifically mentioned as an acceptable management practice in the original Environmental Impact Assessment (U.S. Fish and Wildlife Service, 1978).

Proposed silvicultural treatment alternatives are not intended to be an ongoing action but are meant to reduce fuel loading to the point where vegetation management can be attained using natural processes such as fire. The silvicultural prescription that this and the other treatment alternatives are based on is the result of a scientific study of bald eagle habitat needs and of Bear Valley's specific climate and situation. It is not intended to maximize revenue for the USFWS through timber harvest. Price fluctuations in the value of the timber at the time of contract bids will affect the amount of revenue taken in. As a result, more or less additional work may be accomplished as part of the contract. The fact that income may be generated and the project may pay for itself is a fortunate circumstance that may reduce the impact to the rest of the Service's programs.

Although the intent of the USFWS is to manage eagle roost habitat with prescribed fire in the future this document cannot assure that additional thinning operations in the treated areas will not be necessary at a later date. Further experience in managing the timber stands may show that they were not thinned extensively enough initially and require additional thinning to let them reach

their full potential. Members of the Interdisciplinary Team agree that it would be better to err on the side of leaving more trees in the treated areas now with the understanding that additional thinning may need to take place in 10-20 years rather than try to immediately thin the stands to their minimum density in one stage. Leaving some extra trees allows additional mortality from mechanical damage during thinning operations, soil compaction, prescribed fire, and other unforeseeable causes to occur without affecting the ultimate objective. In the short term, the additional trees remaining will not significantly affect the positive results that thinning will have for forest health.

Alternative 4 - Silvicultural Management and Fire II

Description

This alternative would treat all four subroosts and some additional areas as quickly as possible. One commercial timber sale would be used to thin the forest stands to a scientifically predetermined silvicultural prescription over a three year period. Both ground-based and helicopter or cable timber harvesting operations would take place. Following commercial thinning operations, prescribed fire would be implemented to return the forests to a natural fire regime.

Issues:

Alternative 4 would have many of the same consequences that were listed above for alternative 3. Those desired biological effects of silvicultural manipulation would be greater than alternative 3 due to more acres being treated. Likewise, those consequences which are drawbacks would be greater as well.

Forest Health

The biggest advantage of this alternative is that it treats the largest acreage of land in the shortest amount of time. Since silvicultural manipulation and stand thinning have been shown to reduce tree loss to insects and disease and increase their growth rates this alternative will reduce potential forest health problems more quickly than any other alternative.

Maintain Existing Bald Eagle Roosting Habitat
Providing for Replacement Roost Trees and
Increase Desired Roost Tree Species/Thin White Fir

This alternative is likely to maintain the existing large trees needed for bald eagle roosting habitat, provide near- and long-term replacement roost trees, and increase ponderosa pine and Douglas-fir since it is based on the silvicultural prescription (Appendix A) that is specifically designed for these purposes.

Helicopter and cable logging techniques are best used to extract large, high-value logs from the forest. Less ground disturbance is

created by these methods than by ground-based logging, however, they may not be able to remove the small diameter white fir that should be thinned according to the silvicultural prescription. Ground-based logging may be used to extract smaller diameter timber economically, and some ground disturbance may even be desirable to physically crush small unwanted vegetation.

Eagle Response

Eagle response to silvicultural treatments is likely to be favorable based on results of similar thinning operations in nearby bald eagle habitat areas. The biggest drawback to this alternative is that it leaves no time to determine eagle response. Some modification of the timber sale contract could occur in each year following the first year of the contract if the first year's experience shows a need to operate differently, but even three years is not enough time to completely evaluate improvements in tree mortality and forest health, and it may not be enough time to determine whether eagle response is favorable. Annual fluctuations occur in the number of eagles using Bear Valley as a roost site so population surveys must be carried out over several years to evaluate trends in use of the roost. These variations in eagle use may be related to such things as the variations in the distribution of waterfowl populations, which are used as food by eagles, in the Klamath Basin.

Reintroducing Fire

Same consequences as those of Alternative 3

Increased Susceptibility to Wildfire

This alternative will reduce the probability of catastrophic wildfire more than any other alternative. Fuel loadings would be reduced and the continuity of fuels would be broken by thinning and burning over a greater area than any other alternative. Since this reduction would take place over three years, the possibility of a wildfire destroying parts of the subroosts between the time action is started and the time treatment is finished is lowered.

Safety of Fire Suppression Forces and
Public Safety

Safety of suppression forces and public safety would likewise be improved more quickly than under any other alternative.

Air Quality

Same consequences as those of Alternative 3

Costs

Major costs of road improvement, monitoring the contract, and

preparation for prescribed burning can be incorporated into the timber sale contract. Alternative 4 is more likely to be economically attractive to logging contractors because it offers more acres per year and a three-year commitment. (Alternative 3 guarantees only one year of harvesting at a time.) A preliminary stand examination of the higher elevation areas indicates that these areas may not be as profitable as lower elevation areas. A larger sale covering all areas may be more feasible since the more profitable lower altitude timber stands may help pay for the less profitable higher altitude areas.

Steeper slopes at the higher elevation subroost areas (subroosts 3 and 4) present difficulties that would require more time and effort to plan and carry out than alternatives 3 or 5. Some additional roads may need to be constructed to reach these areas. Ground based logging systems which would be used at lower elevations probably cannot be used on the steeper slopes. A logging systems analysis would need to be done to determine the best logging method for these areas. Helicopter or cable logging, which would probably be used, would be considerably more expensive for the contractor. The result of higher operating costs is that less additional work may be done as part of the contract.

Tax Base/Revenue Sharing with the County

This alternative would derive the greatest revenue from timber sales in the shortest amount of time and has the most potential of the six alternatives to increase revenue sharing with Klamath County.

Local employment

This alternative has the greatest potential to increase local or regional employment of all the alternatives being considered.

Potentially Controversial Issues

The same potential for controversy exists as in alternative 3: the USFWS planning to thin the trees with a silvicultural treatment after previously condemning property to prevent the destruction of roost trees.

Although most experts consulted during the preparation of this document are reasonably certain that silviculturists are able to develop the forest characteristics they write a prescription for, few would want to "put all our eggs in one basket" by imposing a

silvicultural prescription on all the subroosts at once with no provision for determining whether eagle response is favorable or not.

Alternative 5 - Silvicultural Management and Fire III

Description

This alternative would use one commercial timber sale carried out over two years to thin the forest stands to a scientifically predetermined silvicultural prescription. Ground-based timber harvesting operations would treat only half of each subroost. A small area outside of the subroosts would be treated as well. The untreated portions of the subroosts would be left to natural successional processes. Following commercial thinning operations, prescribed fire would be implemented only in the treated portions of the subroosts.

Issues:

The desired biological effects of putting Alternative 5 into action will be similar to those of Alternative 3 but to a lesser extent since fewer acres would be treated. Likewise, more of the negative effects, similar to those of the No Action alternative, will be present.

Forest Health

This alternative will do less to reduce potential forest health problems than alternatives 3 or 4. Since only parts of the subroosts would be treated, the possibility still exists that pathogens may destroy the remainder of the untreated subroost areas before a new habitat improvement project is instituted.

Maintain Existing Bald Eagle Roosting Habitat
Providing for Replacement Roost Trees and
Increase Desired Roost Tree Species/Thin White Fir

This alternative is likely to maintain the existing large trees needed for bald eagle roosting habitat, provide near- and long-term replacement roost trees, and increase ponderosa pine and Douglas-fir in the treated areas only since it is based on the silvicultural prescription (Appendix A) that is specifically designed for these purposes. It will do nothing to alter the natural successional processes in the untreated areas.

Eagle Response

The advantage of this alternative is that it allows adequate time for evaluation of silvicultural treatment and eagle

response.

Reintroducing Fire

Fire will be reintroduced with a good probability of success in the treated portions of each subroost but prescribed burning untreated areas is not planned.

Increased Susceptibility to Wildfire

This alternative will do less to decrease the probability of catastrophic wildfire than alternatives 3 or 4. The parts of the subroosts that are treated would be less susceptible to wildfire, the possibility still exists that wildfire may destroy the untreated subroost areas before a new habitat improvement project is instituted.

Safety of Fire Suppression Forces

Safety of fire suppressions personnel will be improved in the treated areas. Road improvement will allow easier access for equipment while thinning operations will make foot access easier and safer. Landing used for log decks will serve as turn-arounds and safety zones. Treated areas may be able to serve as fuel breaks and safety zones once prescribed burning has been carried out in them. The untreated areas will still be connected and will burn with the same intensity that they would now, so this alternative is only partially successful in increasing personnel safety.

Public Safety

Treating only half of each subroost would only diminish the threat and potential liability of the USFWS for a wildfire that escapes the Refuge boundary slightly. Potential liability of the Service for a prescribed fire that escape would increase but not as much as it would under Alternatives 2, 3, or 4 since fewer acres would be burned.

Air Quality

The same air quality concerns as described under Alternative 2 would be present but to a lesser degree since less burning would be done.

Costs

Major costs of road improvement, monitoring the contract, and preparation for prescribed burning can be incorporated into the timber sale contract. A preliminary stand examination of Bear Valley indicated that the lower elevation areas are likely to be more profitable to log than the higher elevation areas. This alternative will sell much

of these most profitable areas and will probably be economically attractive to commercial operators. Timber sales in the higher elevation areas in the future may be less attractive to logging contractors without the more profitable lower-elevation timber stands tied in to help pay for them.

Tax Base/Revenue Sharing with the County

This alternative would derive the least revenue from timber sales of the three treatment alternatives, however, it still has a slight potential to increase revenue sharing with Klamath County due to the short period of time the sale is spread out over.

Local employment

Of the three commercial thinning alternatives being considered, local or regional employment would be assisted least by this alternative.

Potentially Controversial Issues

The same potential for controversy exists as in alternative 3: the USFWS planning to thin trees with a silvicultural treatment after previously condemning property to prevent roost trees from being destroyed.

Alternative 6 - Silvicultural Experimentation

Description

This alternative will set up six triads of experimental treatment plots. Each fifteen acre triad would consist of two 5-acre treatment blocks and one, 5-acre control plot. One treatment block of each triad will be treated with one silvicultural prescription, the other treatment block with another. The effects of each prescription on forest health and eagle use will then be monitored to determine which prescription would be used in a future large-scale habitat improvement plan.

Issues:

Forest Health

The ability to reduce potential forest health problems in a timely manner will not occur with this alternative; however, improved stand conditions in the localized areas of treatment may occur. General conditions surrounding these

areas will not be affected and may serve as reservoirs of disease and pests that will continue to invade treated areas.

Maintain Existing Bald Eagle Roosting Habitat

This alternative will not maintain the health and vigor of existing eagle roost trees, nor will it create stand conditions that will provide for additional bald eagle roosting habitat needs in the future. It does not treat a large enough portion of the Refuge to have a significant effect on factors that may destroy the subroosts. It will take at least five years to evaluate whether tree mortality has been decreased in the experimental stands. More extensive treatments based on the results of the experimentation will take several more years. In this time, disease and pests may take their toll, and the risk of a stand-replacement wildfire will increase.

Providing for Replacement Roost Trees

This alternative will not provide for near- or long-term replacement roost trees.

Increase Desired Roost Tree Species/Thin White Fir

It will not increase desired roost tree species or thin white fir except in the treatment plots.

Eagle Response

The biggest advantage of this alternative is that it provides for thorough study of eagle response to silvicultural manipulation before additional treatment is performed. In this respect it provides the most assurance that the Bear Valley subroosts won't be made unattractive to eagles as a result of miscalculation of the silvicultural prescription, human disturbance, or other unknown factors.

Reintroducing Fire
Increased Susceptibility to Wildfire
Safety of Fire Suppression Forces and
Public Safety

The natural fire regime will not be reintroduced and the probability of catastrophic wildfire will continue to increase. It will have no effect on the safety of suppression forces or on public safety

Air Quality

Smoke from prescribed burning in experimental units would affect air quality very little.

Costs

The bulk of the costs of thinning operations in the various paired study plots will probably be borne by the USFWS. The study plots are small compared to normal timber sales, thus little interest is expected from commercial logging contractors. The up-front costs to the Refuge complex would be increased, possibly at the expense of other Refuge programs.

Tax Base/Revenue Sharing with the County and Local Employment

This alternative will not increase revenue sharing with the County and would have minimal effect on local employment.

Potentially Controversial Issues

The potential for controversy in respect to timber harvest is low since actions done under this alternative are clearly intended to be experimental in nature. A few people who have knowledge of the potential for wildfire to destroy the roost and the confidence in silviculturists to produce the desired effect may question whether the USFWS can afford to wait for the results of an experimental approach before taking large-scale action.

FINAL BEAR VALLEY ENVIRONMENTAL ASSESSMENT

CHAPTER 5

COMPLIANCE, CONSULTATION, AND COORDINATION WITH OTHERS

LIST OF PREPARERS AND AGENCIES/PERSONS CONTACTED

A. INTERDISCIPLINARY TEAM

Jim Kelton, Assistant Fire Management Officer, IDT Leader (USFWS)
Dave Mauser, Wildlife Biologist (USFWS)
Mike Glass, Fire Management Officer (USFWS)
Ed Arnett, Wildlife Biologist,(formerly with USFWS, currently with Weyerhaeuser)

B. PARTICIPATING SPECIALISTS

Bob Anderson, Wildlife Research Biologist (Weyerhaeuser)
Dr. Robert Anthony, Leader, (OCWRU)
John Bambe, Forester (USFS)
Mike Bechdolt, Timber Manager (BLM)
Alex Bordeau, Archaeologist (USFWS)
Mel Crockett, Forester (BLM)
Dr. Dominick DellaSala, Wildlife Biologist (WWF)
Andy Eglitis, Entomologist, (USFS)
Joe Foran, Fuels Management Specialist (BLM)
Jim Hainline, Wildlife Biologist (USFWS)
Jim Hidy, Refuge Manager (USFWS)
Richard Holthausen, National Wildlife Ecologist (USFS)
William Hopkins, Ecologist (USFS)
Frank Isaacs, Research Assistant, (OCWRU)
Phil Jahns, Silviculturist (USFS)
Bill Johnson, Silviculturist (BLM)
Kim Johnson, Silviculturist (USFS)
Dr. Helen Maffei, Area Forest Pathologist (USFS)
Brian McCarty, Engineer (BLM)
Rob McEnroe, GIS Coordinator/Timber Sale Planner (BLM)
Dave Menke, Recreation Planner (USFWS)
Ralph Opp, Wildlife Biologist (ODFW)(ret.)
Anan Raymond, Archaeologist (USFWS)
Gayle Sitter, Wildlife Biologist (BLM)
Chris Sokol, Forester (Weyerhaeuser)
Faye Weekley, Wildlife Biologist (USFS)

a - BLM = U.S. Bureau of Land Management: OCWRU = Oregon Coopeative Wildlife Research Unit; ODFW = Oregon Department of Fish and Wildlife; OSU = Oregon State University; USFS = U.S. Forest Service; USFWS = U.S. Fish and Wildlife Service; WWF = World Wildlife Fund.

C. LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS SENT SCOPING DOCUMENTS/LETTERS

Agencies:

Bureau of Land Management (Gayle Sitter)
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife (Glen Ardt, Chris Carey, Ralph Opp)
Oregon Department of Forestry (Ed Deblander)
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service (Rolly White)
U.S. National Biological Service - Oregon Cooperative Wildlife Research Unit (Bob Anthony, Frank Isaacs)
U.S. Forest Service (Marc Whisler, Carol Tyson, Brent Frazier, Rick Hardy, Chris Hescock)

City/County:

City of Klamath Falls (George Flitcraft)
Klamath County Commissioners
Soil and Water Conservation District (William Johnson)

Organizations:

Big Valley Timber (Irv Toler)
Boise Cascade (John Grimm)
Burrill Lumber (Dan Goltz)
Circle D Lumber Company (Bob Hellner)
Columbia Plywood Corporation (Mark Slezak)
Concerned Friends of the Winema (Sally Wells)
Crowman Corporation (Duane Cross, Mike Gomez)
Crown Pacific Ltd. (Bill Steers)
Forest Conservation Council (John Talberth)
Gregory Forest Products (Ted Wall)
Klamath Basin Audubon Society
Klamath Tribe (Craig Bienz)
Modoc Lumber Company (Ed Maloney)
National Council of the Paper Industry for Air and Stream Improvement (Larry Irwin)
Natural Resources Defense Council (David Edelson)
National Wildlife Federation
Northwest Forestry Association (Wayne Ludeman)
Oregon Natural Resources Council (Tim Lillebo, Wendall Wood)
Oregon Rivers Council (Bob Doppelt)
Rough and Ready Lumber Company (John Firth)
Sierra Club (Bill Wood)
Southern Oregon Timber Industries Association (Greg Miller)
Thomas Lumber Company (Ken Dunn)
Waldo Wilderness Council (Doug Norlen)
Western Forest Industries Association (David Ford)
Western Timber Company (Cyrus Standley)
Weyerhaeuser Company (Bob Anderson, John Monfore)

Wilderness Society (Bob Freimark)
World Wildlife Fund (Dominick DellaSala)

D. Comments on the Draft Environmental Assessment

Approximately 62 copies of the Draft version of this document were sent out to individuals and organizations who had expressed an interest in receiving information on this project. Approximately 25 letters were sent out informing individuals and organizations that a Draft EA was available and that a copy would be sent on request. Local news media were informed of the proposed action and the availability of the Draft EA. A public tour of Bear Valley NWR was held on November 4, 1995 which outlined the reasons for proposing the action and allowed interested members of the public to see conditions at the Refuge for themselves. 15 people participated on this tour. Lists of those who received letters, copies of the Draft EA, and attended the public tour are found in the Bear Valley EA files at the Refuge Complex headquarters.

Eight written comments were received on the Draft EA. Most comments were generally supportive of the need to carry out management activities in the Refuge. As a result of these comments, the Final EA has had a number of changes made to it. The following is a summary of significant comments received and how they have affected the Final EA.

- The preferred alternative in the Draft EA was too aggressive - it would treat too much of the Bear Valley roost too quickly without adequate time for monitoring. Too much emphasis was placed on a multi-year timber sale approach.

  Multi-year sales were originally proposed to decrease the amount of administrative effort spent on contract and to increase the volume of timber offered in a package to make the sales more attractive to prospective bidders. This was based on the presumption that problems in the treatment could be adjusted at any time by modifying either the first or second contract.

  In response to these comments the preferred alternative has been altered so that it consists of a series of five stand-alone commercial thinning sales, separated by at least one year of monitoring. This approach will decrease the possibility of harming a large proportion of the roost habitat at Bear Valley. It may require more administrative effort and may make the area less attractive to contractors, but it will also eliminate any difficulties or reluctance to cancel or alter the terms of a multi-year thinning contract once it has been awarded.

- There is too much emphasis on reliance on commercial timber sales and the potential contributions to the local economy and employment.

  The USFWS guidelines for preparing an EA to comply with requirements of the National Environmental Policy Act (NEPA) recommend that the consequences of the action in terms of costs and effects on the

local economy be examined for each alternative proposed. While these factors were considered, they were not criteria for selection of the preferred alternative.

Several alternatives propose using commercial timber sales to implement silvicultural treatments. Numerous discussions have taken place among various USFWS staff, who are familiar with USFWS and Federal fiscal constraints, on the availability of staff and funding to carry out treatment and monitoring activities. The conclusion reached was that given current and foreseeable budget constraints and the other important priorities for the Klamath Basin NWR Complex, a commercial timber sale is the only feasible way that habitat improvement actions can be undertaken.

- The USFWS should not remove any trees larger than 14" DBH.

The silvicultural prescription proposed in the Draft EA is still retained in the Final EA as "Prescription A". The study on which it is based (DellaSala et al. 1987) gave a target density of trees per acre to which the subroosts should be thinned. It advised no restrictions on the size of trees that could be cut to reach that target density or differences in the prescription between subroosts although it acknowledged differences in stand composition and density between subroosts. The objective of this target density was to "maintain adequate spacing between trees for development of heavy branches and unobstructed flight of eagles." This target density was analyzed by silviculturists with the BLM who advised the USFWS that this target density could met and the health of remaining trees could be increased if a few large trees were judiciously removed - a sound silvicultural practice. Additional input from Bob Anderson, who has considerable experience at managing eagle habitat, recommended other circumstances where removal of a few larger trees would probably benefit the eagles by allowing more space between the crowns to allow for unobstructed flight. Furthermore, this prescription is specific to Treatment Area 1 of Alternative 3, which contains little subroost area.

After circulating the Draft EA, the USFWS received new information on bald eagle roost preferences based on a new analysis of data collected for the 1987 report (D. DellaSala, World Wildlife Fund, unpubl. data). Since this latest information shows that clumps of large trees may be more important than individual large trees in the selection of roost trees by eagles, the preferred alternative has been changed so that two sections of Treatment Area 1 will be cut under a prescription that would remove no trees larger than 14" DBH ("Prescription B", Appendix B). This more conservative marking guide also eliminates the possibility of cutting some roost trees which have no castings around the base and thus, may not be identified as roost trees.

After evaluating the results obtained by the two prescriptions in Treatment Area 1, the better of the two prescriptions can be used for the next treatment area. Evaluation may show that one or both

- Selectively leave preferred roost tree species (ponderosa pine and Douglas fir).
- Reduce stocking densities to levels that will maximize the health and vigor of remaining large trees.

The main silvicultural treatment is "thinning from below", which maintains the upper canopy while thinning the mid-canopy and understory. This concept is important when trying to visualize what effect this prescription will have.

Anyone who is not used to working with timber may have a difficult time picturing what the forest will look like after this prescription is implemented. The overall height of the canopy will not change significantly since the biggest and tallest trees are being left (with only a few exceptions). Once the understory is thinned, the overall result will be an open, park-like effect on the ground with well-spaced large trees and very little undergrowth. The tree canopies will be somewhat separated but will grow closer together as time passes. This description is oversimplified since a series of smaller trees will also be left to provide replacement roost trees in the future, but it may help to give the indication of the intended objectives. Another simplified visual image that may help is that the intent of this action is to transform second-growth and late-successional forest into late-successional or "old-growth forest", respecively, leaving the biggest and best trees.

When thinning is complete, residual trees would have adequate room for growth and development. When trees grow side by side and too close to another, the limbs tend to be stunted on the side that competes with the other tree. Adequate spacing between trees helps them to develop larger limbs and a more open-branched structure which are preferred roost tree characteristics.

Reduced competition among trees after thinning will generally increase their health and decrease their susceptibility to insect and disease attack. Thinning will also reduce ladder fuels contributed by the understory.

Table 1 presents stocking densities and approximate spacing for Douglas-fir and ponderosa pine suggested by Oregon State University and USFS researchers (DellaSala et al. 1987) for the Bear Valley NWR. Target stocking densities of Douglas-fir and ponderosa pine in all size classes should range between 72 and 171 trees/acre, with an average target stocking density of 121 trees/acre, which equates to an average spacing of about 20' between the trees that are left.

Table 1. Target densities and approximate spacing, by size class, for Douglas-fir and ponderosa pine within subroosts at Bear Valley NWR, suggested by DellaSala et al. (1987).

Size Class (in)	Density (No./Acre)	Approx. Spacing (ft)
< 3	40 - 100	18 - 30
3 - 10	14 - 35	30 - 50
10 - 20	10 - 20	40 - 60
> 20	8 - 16	50 - 65

These densities are the basis for the prescription that will be implemented at Bear Valley NWR. However, they have been supplemented by recent local experience in manipulating bald eagle habitat on BLM, USFS, and Weyerhaeuser Company lands. Some interpretation and professional judgement is necessary to translate the recommended broad guidelines to the detailed instructions that timber marking personnel and logging equipment operators will be guided by.

This will be a "leave tree" marked sale, that is, all trees that are to be left will be marked; any tree greater than 3" not marked will be harvested by the logging operations. All known roost trees will be marked to leave and should take precedence when determining the spacing arrangement of other trees to be left in any given stand. Leave tree preference, in order of decreasing importance, would be: (1) any known roost tree, regardless of species; (2) ponderosa pine; (3) Douglas-fir; (4) incense cedar; and (5) large diameter (greater than approximately 20 inches DBH) white fir. White fir and western juniper should always be favored for removal over any other species. Few sugar pine occur on the Refuge but where they are present they should be given the highest priority as leave trees to make up for their current underrepresentation in the stands; none over approximately 14 inches DBH should be harvested.

To allow for mortality from underburning, insects, windthrow, etc., stocking density guidelines would be slightly (10-20%) higher than shown on Table 1. Consultation with silvicultural experts indicated that it would be feasible to leave a higher density of trees in this first thinning entry with the understanding that additional thinning may need to occur in 10-20 years to reach optimal densities. Approaching the thinning this way gives more room for error than trying to achieve the exact end result in one action. Additional trees may be removed anytime, but once a tree is cut down it will take years to replace it.

To meet snag requirements for cavity excavating species the minimum snag retention, where available, would be: 1 snag greater than 20" DBH per acre and 2 or more snags greater than 12" DBH per acre (Brown,

1985). Snags in excess of this number would be available for timber harvest or fuels treatment. Snag density appears to be more than adequate in the areas where detailed stand exams have been done and the forestry experts consulted believe that additional snags will be present as mortality occurs. Therefore, most of the smaller excess snags will be removed because of the hazard they present to personnel during prescribed burning and wildfires. Retained snags are not to be considered when determining spacing of the next leave tree.

Dominant and co-dominant spike-top trees (that is, the tallest or among the tallest trees in the stands) should generally be retained, because they are often preferred for roosting by eagles (DellaSala et al. 1987). There are many smaller spike-top trees present, especially damaged or dying white fir, which will be harvested since they are not tall enough to extend into the upper canopy.

Existing and potential roost trees would be cultured to reduce vegetative competition and stress. Within a 60' radius of larger roost trees (19' DBH and larger), most understory trees would be removed. Less than half the residual tree density shown on Table 1 would be left within the 60' radius circle. Where smaller roost trees (less than 19" DBH) have been identified, a radius of 30' would be used. In addition, dominant and codominant trees whose crowns are within 6' of the roost tree crowns would be removed to "daylight" the roost tree crown to allow entry and exit of flying bald eagles.

Culturing individual roost trees on steep slopes (greater than 35% or where specialized equipment cannot work) will also occur under these alternatives. Roost trees identified for treatment will have all brush and trees less than 5 inches DBH removed from at least one crown width away from its bole (generally 20-50 feet). Slash would be hand-piled away from the roost tree and left for wildlife habitat.

There are several known nesting sites identified at the Bear Valley NWR. Within a 60' radius of nest trees all trees (with the exception of adjacent dominant or co-dominant trees which are used as perch or replacement nest trees) would be removed. In the general area around nest trees (1-2 acres), 2 or 3 larger ponderosa pine or Douglas fir per acre would be identified as potential alternate nest trees, for both the near term and the long term (20+ years).

Large trees (greater than approximately 19") will generally not be removed. However, in some cases these trees may be harvested judiciously if necessary to meet the silvicultural objectives. For example, the roots of the trees compete with each other many crown widths out from the base of the trunk; the larger the tree, the larger the area its roots spread out over. One of the few cases where larger trees (but not known roost trees) would be removed is when a clump of several large potential roost trees exists. Each tree influences each other and none is likely to prosper and develop as well as they would with less competition. In such circumstances, large trees may be removed if an experienced professional forester recommends that the health of the others will be improved by their removal. Other examples of reasons why large trees would be removed include:

- A large white fir suppressing a highly desirable tree
- Large trees, whose crowns are within 6' of an existing or potential roost tree, which would block bald eagle entry and exit from the roost tree
- Diseased trees, such as broomy mistletoe-infested ponderosa pine over a healthy ponderosa pine understory

Some stands have closed canopies that do not allow regeneration of ponderosa pine. Ponderosa pine seedlings, a "shade intolerant" species, will not grow in areas where full sunlight is blocked by the canopy of other trees. Due to the rapid growth and density of white fir, which is a "shade tolerant" species, some stands have no young ponderosa pines to speak of. To open the canopy, well-distributed patch cuts under 3 acres in size, may be made. A partial overstory of 5-10 larger trees per acre could be left for structural and habitat diversity. Ponderosa pine seedlings would then be planted in the patch openings. These seedlings would grow to be potential roost trees in 100-150 years. Ponderosa pine seedlings are tolerant of fires and will generally survive a low-intensity fire. The same fire, however, will usually kill white fir saplings. Therefore, periodic prescribed fires will tend to keep the same condition from recurring. Patch cuts would only be made outside the present core roost areas.

A contractor would not be obligated to take unmarked trees smaller than 3". It is not economically feasible to harvest this size and small unmarked trees may be crushed or damaged during harvesting operations anyway. Desirable trees smaller than 3" may be marked as leave trees in order to receive protection by the contractor during harvesting operations. Trees less than 3" remaining on the site which are not fire resistant are likely to be killed by prescribed fires following thinning operations.

Habitat for other wildlife species will be accommodated whenever possible during on-the-ground marking operations. The target densities listed in table 1 above are theoretical averages to be obtained over the whole treatment area, and stand examinations are based on sampling of a number of plots within the unit. The detailed marking guidelines which timber sale markers will use include provisions to leave beneficial habitat structures which it is nearly impossible to detect until the process of marking every single leave tree takes place. These guidelines, which are developed by a wildlife biologist, include marking to leave such things as clumps of trees which will not affect roost trees but which serve as thermal cover for deer, and nests of other bird species such as goshawks. BLM reports that their timber marking crews are experienced in detecting these habitat features and capable of making the judgements needed to preserve them.

Prescription B - Alternative 3:

In addition to the objectives listed above, specific silvicultural objectives are to:

- Preserve all trees of any species which may potentially be used

as roost trees by eagles (14" or larger).
- Retain a higher density (clumps) of larger diameter trees and the unique characteristics which these groupings may offer.

This silvicultural treatment would also be accomplished by "thinning from below" and the prescription is intended to be basically identical to Prescription A as far as understory thinning is concerned. It differs from Prescription A in its treatment of larger trees. In Prescription B, all trees larger than 14" (35 cm) would be retained. No trees of this size would be removed, even if the special conditions listed above for removal of large trees are present. This will ensure that no roost trees, known or otherwise, are removed, and will preserve a higher density of large trees surrounding roost trees. This latter factor may be important to eagles in their selection of roost trees.

Since all trees larger than 14" would be left, some residual trees would be expected to have less room for growth and development than under prescription A. It would also be expected that increased competition will be present in those stands of trees where several large trees are left in close proximity to each other. However, since the trees have developed to the point that they are fairly large in spite of being close together, there may be some environmental factor present which will allow them to continue to grow this way.

Due to safety considerations for prescribed fire personnel, treatment of snags would be the same as for Prescription A. Because a higher number of larger green trees would be left, there will be a larger pool of potential snag recruits for the future than under prescription A.

Culturing of existing roost trees and potential roost trees would not take place as described above since this might involve removing trees larger than 14". Culturing roost trees on steep slopes by hand to remove understory vegetation to the same standards as for mechanical thinning operations would take place.

Prescription - Alternative 6:

This alternative is intended to test hypotheses about eagle response to two different silvicultural treatments. Treatment plots will be 5 acres in size and paired with a 5 acre control. Each treatment/control plot triad would be replicated 3 times in low-elevation subroosts 1 and 2, and 3 times in high elevation subroosts 3 and 4 (refer to Figure 3f). Thus, a total of 30 acres for each spacing regime would be manipulated within the subroosts (total treatment = 60 acres).

This would also be a "leave tree" marked sale. One treatment plot will employ a general 20 foot spacing among leave trees, while the other will use a 10 foot general spacing among residuals. All known roost trees will be marked to leave and should take precedence when determining the spacing arrangement of other residual trees throughout any given stand. Leave tree preference, in order of decreasing importance, would be: 1) any known roost tree, regardless

of species; (2) ponderosa pine; (3) Douglas-fir; (4) incense cedar; and (5) large diameter (greater than approximately 20 inches DBH) white fir. White fir and western juniper should always be favored for removal over any other species. Few sugar pine occur on the Refuge but where they are present they should be given the highest priority as leave trees to make up for their current underrepresentation in the stands; none over approximately 14 inches DBH should be harvested.

To meet snag requirements for cavity excavating species the minimum snag retention, where available, would be: 1 snag greater than 20" DBH and 2 or more snags greater than 12" DBH acre (Brown, 1985). Snags in excess of this number would be available for timber harvest or fuels treatment. Snag density appears to be more than adequate in the areas where detailed stand exams have been done and the forestry experts consulted believe that additional snags will be present as mortality occurs. Therefore, most of the smaller excess snags will be removed because of the hazard they present to personnel during prescribed burning and wildfires. Retained snags are not to be considered when determining spacing of the next leave tree.

Dominant and co-dominant spike-top trees (that is, the tallest or among the tallest trees in the stands) should generally be retained, because they are often preferred for roosting by eagles (DellaSala et al. 1987). There are many smaller spike-top trees present, especially damaged or dying white fir, which will be harvested since they are not tall enough to extend into the upper canopy

APPENDIX B

MONITORING

The following monitoring plan has been developed by Klamath Basin National Wildlife Refuge Complex wildlife biologist Dave Mauser with advice from Dr. Robert Anthony at the Oregon Cooperative Wildife Research Unit. This plan is specific to monitoring the proposed thinning of Treatment Area 1 of Alternative 3 as shown in figure 3c. Since the preferred alternative involves an adaptive management approach that builds and improves on the previous treatments, additional monitoring plans will need to be developed to gauge the effects of subsequent thinning operations. Interdisciplinary participation and input will be solicited from the following specialists:

Bob Anderson, Wildlife Research Biologist (Weyerhaeuser)
Ron Anglin, Wildlife Biologist (ODFW)
Dr. Robert Anthony, Oregon Cooperative Wildlife Unit (OSU)
Andy Eglitis, Entomologist, (USFS)
Monte Garret, Wildlife Biologist, (Pacific Power)
Mike Glass, Fire Management Officer (USFWS)
Kelly Goocher, Wildlife Biologist (USFWS)
Rick Hardy, Wildlife Biologist (USFS)
William Hopkins, Ecologist (USFS)
Dr. Frank Isaacs, Research Associate (OSU)
Bill Johnson, Silviculturist (BLM)
Dave Mauser, Wildlife Biologist (USFWS) - Team Leader
Ralph Opp, Wildlife Biologist (Oregon Eagle Foundation)
Gayle Sitter, Wildlife Biologist (BLM)
Brian Woodbridge, Wildlife Biologist (USFS)

As many members from this team as possible will meet periodically to view and discuss treatments as they occur and review monitoring data. The "team" ultimately will provide input into future directions and suggest improvements to the program.

EFFECTS OF TWO SILVICULTURAL PRESCRIPTIONS ON BALD EAGLE USE OF WINTER ROOST HABITAT ON BEAR VALLEY NATIONAL WILDLIFE REFUGE

INTRODUCTION

Bear Valley National Wildlife Refuge (NWR) (4,178 acres) was established in 1978 as a communal winter roost for bald eagles (Haliaeetus leucocephalus) and is located approximately 5 miles north of the California border near Worden, Oregon. The refuge ranges from 4,090 to 6,596 feet above mean sea level. Lower elevation areas are dominated by ponderosa pine (Pinus ponderosa) and juniper (Juniperus occidentalis) with higher elevations dominated by Douglas fir (Pseudotsuga menziesii), ponderosa pine, and white fir (Abies concolor) with lesser quantities of incense cedar (Calocedrus decurrens) and sugar pine (Pinus lambertiana). South facing slopes and past clear cuts contain manzanita (Arctostaphalus sp.) and snowbrush ceonothus (Ceonothus velutinus).

Prior to acquisition by the Fish and Wildlife Service (FWS), the refuge was selectively logged whereby the largest and best quality trees were removed. Keister and Anthony (1983) determined a range of 23.5 to 31.7 stumps/acre within sampled areas on the refuge. Remaining eagle roosting habitat occurs in areas where some large trees remain. Four subroosts have been identified (Keister 1981, Dellasala et al. 1987) (Fig. 1) on Bear Valley NWR. In addition to Bear Valley NWR's use as a communal winter roost, the refuge was host to 3 active bald eagle nests in 1995 (Fig. 1).

After the refuge was purchased, it became apparent that management of the roost would be required to ensure it's sustain ability over time. Fire exclusion and high grade logging had resulted in stand conditions that contained an unsupportable tree density. In addition, high tree densities coupled with large quantities of down fuel have greatly increased the probability of catastrophic wildfire. To reduce fuel loadings on the refuge, the FWS began a program of prescribed fire in the late 1980's. Burning was successful at low elevations where fuel loads were relatively light; however, as the burning program moved up slope, high densities of smaller trees, especially white fir, acted as ladder fuels, carrying fire into the crowns of older trees. At this point it was decided that silvicultural treatments were required prior to prescribed burning at higher elevations. After silvicultural work was completed, fire could be re-introduced to higher elevations in the roost.

Starting in August of 1996, Klamath Basin refuges is proposing silvicultural treatments on 255 acres of Bear Valley NWR using 2 silvicultural prescriptions. The first (Prescription A) will leave approximately 121 trees/acre (Table 1) with a range of 72 to 171 trees/acres. This equates to an average spacing between trees of about 20 feet. The

second (Prescription B) is identical to the first except no trees >14 inches dbh will be removed. Because silvicultural treatments have not been attempted or the effects evaluated within bald eagle winter roost habitat, a study design is proposed to evaluate the effect of these prescriptions on use of roost trees by wintering eagles.

OBJECTIVES

1. Determine if silvicultural treatments are negatively impacting eagle use of roost trees.

2. Determine if silvicultural treatments are negatively impacting total use of Bear Valley NWR as roosting habitat for wintering bald eagles.

3. Determine if silvicultural treatments are impacting survival of know roost trees.

METHODS

Objective 1.

Two study sites (Fig. 1) Incorporating prescription A, B, and a control will be established on Bear Valley NWR. Within each treated and control area, all roost trees (as indicated by ≥2 castings) will be located. Roost trees will be tagged with individually numbered aluminum tags and the location plotted with a GPS unit. Figure 2 depicts data to be recorded at each roost tree. Mean number of castings below marked roost trees can then be compared in pre- and post treatment and control sites over time.

Pre-treatment data will be collected June of 1996 and post-treatment data in June of 1997 and 1998. In addition to roost tree data, pre- and post-treatment stand exams will be performed in each study area.

Objective 2.

Total bald eagle use of Bear Valley NWR has been monitored on a twice/month basis for the last 4 years. Under this program, bald eagles leaving the refuge at the mouth of Bear Valley are counted from 45 minutes prior to sunrise to approximately 2 hours after sunrise. This program will continue at least 4 years beyond the initiation of silvicultural treatments and will be used to detect overall changes in the use of Bear Valley NWR. Eagle use of Bear Valley NWR will be expressed as a proportion of total eagles wintering within the Klamath Basin as indexed by periodic waterfowl surveys, which are conducted twice monthly from September to April on both public and private lands. Every effort will be made to monitor roosting populations at Bear Valley NWR on the same date as the waterfowl surveys.

Objective 3.

During both pre- and post treatment monitoring activities, both canopy and crown classification values (Dellasala et al. 1987) will be assigned to each roost tree. Any deterioration in tree condition over time can thus be documented. In addition, condition of trees marked during previous eagle roost habitat studies (Keister 1981, Dellasala et al. 1987) can be determined and yearly tree mortality rates of previously marked roost trees calculated.

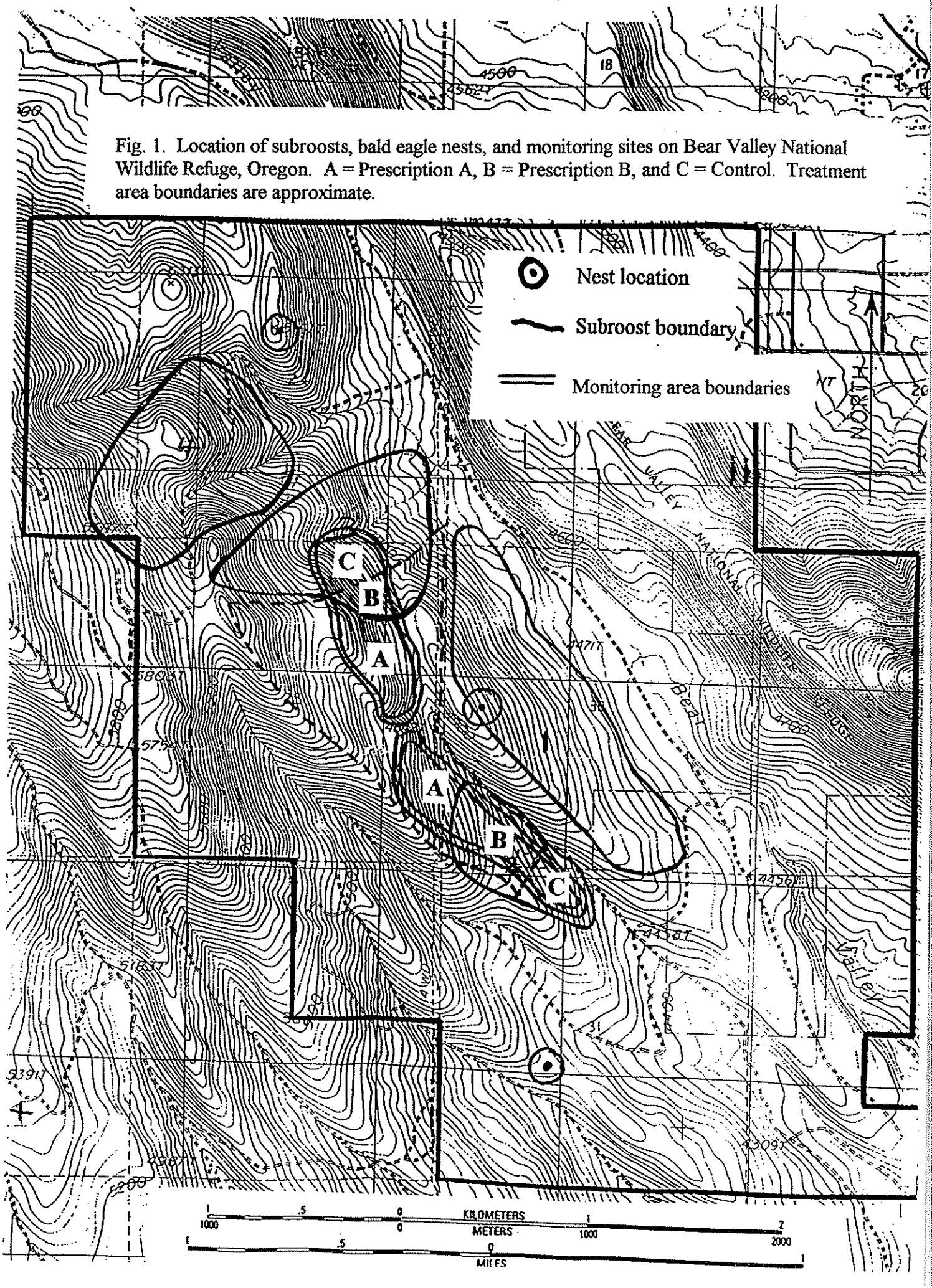


Fig. 1. Location of subroosts, bald eagle nests, and monitoring sites on Bear Valley National Wildlife Refuge, Oregon. A = Prescription A, B = Prescription B, and C = Control. Treatment area boundaries are approximate.

ROOST TREE DATA FORM
Bear Valley NWR

Date	Study Site #	Prescription	Species	# Castings	Tree #	Previous Mark #	Canopy Classification	Crown Classification	Comments

Study site: 1 or 2
Prescription: A,B, or C
Tree #: ie. 96-01 (yr-#)

Previous mark?: Y/N
Species:

Canopy classification: 1-4
Crown classification: 1-4

Figure 2 Sample date form for evaluating bald eagle roost tree use at Bear Valley National Wildlife Refuge, Oregon.

APPENDIX C

COMMON WILDLIFE SPECIES FOUND AT BEAR VALLEY

Table 1. A list of mammals observed at Bear Valley National Wildlife Refuge, Oregon.

Common Name	Scientific Name
Pronghorn Antelope	*Antilocapra americana*
Coyote	*Canis latrans*
Elk	*Cervus elaphus*
California Ground Squirrel	*Citellus beecheyi*
Golden-mantled Ground Squirrel	*Citellus lateralis*
Porcupine	*Erethizon dorsatum*
Yellow Pine Chipmunk	*Eutamias amoenus*
Mountain Lion	*Felis concolor*
Snowshoe Hare	*Lepus americanus*
Black-tailed Jackrabbit	*Lepus californicus*
Bobcat	*Lynx rufus*
American Marten	*Martes americana*
Meadow Vole	*Microtus pennsylvanicus*
Longtail Weasel	*Mustela frenata*
Bushytail Woodrat	*Neotoma cinerea*
Deer Mouse	*Peromyscus maniculatus*
Mule/Black-tailed Deer	*Odocoileus hemionus* spp.
Shrews	*Sorex* spp.
Mountain Cottontail	*Sylvilagus nuttalli*
Chickaree	*Tamiasciurus douglasi*
Badger	*Taxidea taxus*
Black Bear	*Ursus americanus*

Table 2. A list of common birds at Bear Valley National Wildlife Refuge, Oregon.

Common Name	Scientific Name
Cooper's Hawk	Accipiter cooperii
Northern Goshawk	Accipiter gentilis
Sharp-shinned Hawk	Accipiter striatus
Red-tailed Hawk	Buteo jamaicensis
Rough-legged Hawk	Buteo lagopus
Merlin	Falco columbarius
American Kestrel	Falco sparverius
Golden Eagle	Aquila chrysaetos
Bald Eagle	Haliaeetus leucocephalus
Turkey Vulture	Cathartes aura
Great Horned Owl	Bubo virginianus
Northern Pygmy Owl	Glaucidium gnoma
Flammulated Owl	Otus flammeolus
Great Gray Owl	Strix nebulosa
Common Flicker	Colaptes auratus
Lewis' Woodpecker	Melanerpes lewis
White-headed Woodpecker	Picoides albolarvatus
Black-backed Woodpecker	Picoides arctus
Downy Woodpecker	Picoides pubescens
Yellow-bellied Sapsucker	Sphyrapicus varius
Scrub Jay	Aphelocoma coerulescens
American Crow	Corvus brachyrhynchos
Common Raven	Corvus corax
Steller's Jay	Cyanocitta stelleri
Clark's Nutcraker	Nucifraga columbiana
Gray Jay	Perisoreus canadensis
Black-billed Magpie	Pica pica
Brown Creeper	Certhia americana
Mountain Chickadee	Parus gambeli
Bushtit	Psaltriparus minimus
White-breasted Nuthatch	Sitta carolinensis
Red-breasted Nuthatch	Sitta canadensis
Pygmy Nuthatch	Sitta pygmaea
Olive-sided Flycatcher	Contopus borealis
Western Wood-Pewee	Contopus sordidulus
Brewer's Blackbird	Euphagus cyanocephalus
Varied Thrush	Lxoreus naevius
Townsend's Solitaire	Myadestes townsendi
Western Tanager	Piranga ludoviciana
Golden-crowned Kinglet	Regulus satrapa
Mountain Bluebird	Sialia currucoides
Western Meadowlark	Sturnella neglecta
Tree Swallow	Tachycineta bicolor
Bewick's Wren	Thryomanes bewickii

American Robin	Turdus migratorius
Mourning Dove	Zenaida macroura
Evening Grosbeak	Coccothraustes vespertinus
Cassin's Finch	Carpodacus cassinii
Dark-eyed Junco	Junco hyemalis
Green-tailed Towhee	Pipilo chlorurus

LITERATURE CITED

Dellasala, D. A., R. G. Anthony, and T. A. Spies. 1987. A habitat management plan for bald eagle (Haliaetus leucocephalus) communal roost sites at the Bear Valley National Wildlife Refuge, Oregon. Oregon Coop. Wildl. Res. Unit, Oregon State Univ., unpubl. rep. 77pp.

Keister, G. P. 1981. Characteristics of winter roosts and populations of bald eagles in the Klamath Basin. M.S. Thesis, Oregon State Univ., Corvallis, 82pp.

_____, and R. G. Anthony. 1983. Characteristics of bald eagle communal roosts in the Klamath Basin, Oregon and California. J. Wildl. Manage. 47:1072-1079.

Table 1. Target densities and approximate spacing, by size class, for Douglas fir and ponderosa pine within subroosts at Bear Valley NWR, Oregon. (from Dellasala et al. 1987).

Size Class (in)	Density (No./Acre)	Approx. Spacing (ft)
<3	40-100	18-30
3-10	14-35	30-50
10-20	10-20	40-60
>20	8-16	50-65