CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Introduction

This chapter describes and compares the alternatives considered for the Kings River Project (KRP). It includes a description of each alternative considered. Maps are found in Appendix F. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (e.g., helicopter logging versus the use of skid trails) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (e.g., the amount of erosion caused by helicopter logging versus skidding).

Each Alternative incorporates the concept of wildfire entering the landscape and burning one or a couple of the initial eight management units ten years after the record of decision for the purpose of modeling and analysis of effects. The ten year period was chosen not as a prediction, but because it would test the effectiveness of the proposed action after all treatments have been accomplished versus the no action alternative and it would display a comparison to the decision maker of the indirect and cumulative effects of the alternatives.

There is a higher risk of wildfire surrounding the national forest resulting from ignition sources from increased recreational users, more homes in the Wildland Urban Interface (WUI) and general population growth. Other factors or conditions such as drought, and weather patterns affect wildfire behavior. Return intervals of drought or severe fire conditions (97^{th} percentile fire weather conditions) are uncertain. Considerable variability in the intensity and duration of severe fire conditions exists. However, historical weather information (both within KRP and for the Sierra Nevada as a whole) indicates that there is a certainty that drought and severe fire conditions will return (North and others 2005, SNEP 1996). Based upon the historical weather information the assumption has been made that the return of wildfire is a reasonably foreseeable event. Fire records for the KRP indicate it is likely one or more of the management units could be significantly affected by a stand replacing fire on a hot windy summer day, but it is unlikely numerous management units or an entire large watershed would be affected at one time.

Alternatives Considered in Detail

For the Draft Environmental Impact Statement (EIS), the Forest Service developed two alternatives, the Proposed Action (Alternative 1) and No Action (Alternative 2) alternatives. Three alternatives were considered but eliminated from detailed study. In response to comments on the Draft, the Reduction of Harvest Tree Size Alternative is brought forward and analyzed in detail in this Final EIS as Alternative 3.

Alternative 1

The Proposed Action

The proposed action is a series of treatments that was developed over several years by the interdisciplinary team. The sequence of entry or schedule was developed with input and interaction with Pacific Southwest Research Station (PSW) researchers in an attempt to eliminate or minimize adverse impacts to resources in the KRP area.

Implementation of this alternative will require an amendment to the Land and Resource Management Plan (LRMP) standards and guidelines established for the Sierra National Forest, particularly for the harvest of tress greater than 30" in diameter, and for the regeneration group treatments.

The action proposed by the Forest Service is to implement a series of activities to meet the purpose and need for the Kings River Project (KRP). The EIS applies only to the first stage (2006 through 2008) that includes application of the KRP uneven-aged silvicultural strategy and prescribed fire upon the initial eight management units totaling approximately 13,700 acres. For more specific information about the proposed action, please refer to Tables 2-1 through 2-13 that begin on page 2-12.

In addition to the site-specific analysis of the eight management units, this EIS includes an analysis of the cumulative effects of establishing 10 management units as no treatment-controls, and the treatment of one unit (South of Shaver) under an existing decision. The controls are intended for use in a future uneven-aged management study and may also be used for other study and monitoring purposes. (For information on the process for selecting them and their location, see the project record.)

The proposed action will begin implementation of a landscape level program of uneven-aged silviculture and prescribed fire. In doing so it is the intent of the Forest Service to examine the response of key environmental concerns to these forest management prescriptions. In particular, the PSW of the Forest Service has put in place the Kings River Experimental Watershed (KREW) research project to examine chemical, physical, and biological response in first order streams to the planned forest management practices. In addition, research will be conducted to assess response of California spotted owl(s) (CSO) to this first set of treatments. PSW has planned to monitor response of those owls whose habitat is subject to treatment as well as a number of neighboring owl pairs whose habitat will remain unmanaged during this initial five year treatment phase. Fishers will be monitored based on recommendations from PSW. Results from both the owl and fisher work will be used to evaluate longer term effects of this forest management prescription on these sensitive species for planning future land management activities in the Kings River Project area.

The initial eight management units were chosen to:

- Provide priority treatment to the WUI as much as possible, so both adjacent landowners and the forest is at reduced risk from wildfire.
- Carry out activities planned in the KREW and CSO studies.
- Initiate measures to minimize the impact on Pacific fisher and other old forest dependent species such as old forest linkages (OFL) and dispersion of treatment effects in time and space.

For a detailed description of the development of these and other elements of the proposed action, please see "Strategy for Historical Forest Restoration using Uneven-aged Silviculture and Prescribed Fire" which is incorporated by reference and included in Appendix C.

The KRP uneven-aged silvicultural strategy (prescription) addresses the objectives of restoring the historical pre-1850 forest conditions through altering stand structure and composition and returning fire into the ecosystem.

The current inter-agency memorandum of understanding (MOU) signed by both the Station Director (PSW) and Regional Forester (Forest Service) directs the High Sierra Ranger District to implement an uneven-aged silvicultural strategy with a group selection regeneration method across the Kings River Project area and provide an opportunity for research to study the effects (USDA 2002). Thinning would occur in the matrix and regeneration would occur in groups. The Sierra National Forest had been implementing an uneven-aged silvicultural strategy in the KRP area for the past 10 years. Some adaptations have been made and a somewhat different system, referred to as the KRP uneven-aged silvicultural strategy, developed.

The proposed system is defined by a tree distribution regime in the matrix that conforms to an inverse J-shaped curve for trees 11" diameter breast height (dbh) and greater in diameter with regeneration in groups. The inversed J-shaped curve is defined by a diminution quotient (Dq) that has 20% fewer trees in one diameter class then the next smaller diameter class (Dq 1.2), a residual stand density that varies across the landscape, and the largest tree size grown in 200 years. Regeneration is achieved in groups that are less than three acres in size.

The first adaptation is that some stands would be single storied but others two or three storied. Each aerial arrangement of tree size/age classes would contain natural openings (meadows, rock, and low productivity site), young reforestation groups, various middle age groups and large trees. Within single storied stands, size and age class is varied providing a mosaic distributed horizontally. Within a multi-storied stand, size and age classes are distributed vertically (one or two under another) as well as horizontally. The landscape would be composed of a mosaic of single and multi-storied stands. Single storied stands are preferred in the WUI to minimize the fuel ladder and reduce the potential for crown fires. Multi-storied stands would be emphasized in Protected Activity Centers (PAC), fisher habitat and drainage bottoms.

The second adaptation is to maintain one-third of the growing space in large trees, maintain larger trees within reforestation groups when present, and a reduction in the reforestation group size. Increasing the number of large trees is one of the needs in the KRP. While the uneven-aged strategy was developed as a means of restoring the pre-1850 historical forest condition, meeting wildlife habitat needs and reducing the risk of stand replacing fire, a new approach to large tree retention maintains one-third of the growing space in large trees. This is similar to strategies developed for the Southwest (Covington and others 1997) and the Sierra Nevada (Hollenstein and others 2001). Part of the adaptation for large tree retention is maintaining legacy trees in reforestation groups. Reforestation groups would keep all trees larger than 35 inches dbh and where trees larger than 35 inches dbh are not present, four trees larger than 24 inches dbh would be retained.

A third adaptation has been made from relying on the desired basal area, as was done in the initial KRP, to allow the desired canopy cover to drive the residual stand structure. The KRP uneven-aged silvicultural strategy attempts to have a desired canopy cover play a significant role in dictating the residual stocking level rather than approaching it from the typical standpoint of setting artificial canopy cover minimums. The desired canopy cover is achieved when all the diameter classes are represented in the stand.

While it is tempting to assign a CA Wildlife Habitat Relationship (CWHR) size and canopy cover class to each stand, it would fail to capture the dynamic and ephemeral nature of structure within any Potential Natural Vegetation (PNV) type. Thus, it is difficult to assign a stand one historical canopy number. No matter what number is chosen it is certainly wrong for that stand depending on how ecological processes have affected a stand and when it is measured. It is more appropriate to assign a stand a range in canopy cover, than to give an exact number.

In order to assign canopy cover ranges to each combination of landscape factors a set of criteria was created. This criteria were based on descriptions of the Kings River Project area by Sudworth (1900a), Flintham (1904), historical photos of the Sierra National Forest taken from 1870 to 1930, a review of the literature describing the historical forest structure and process (described in Appendix A), 1914 cruise data from the Kings River Project area, 1926 cruise data from the area (USDA 1926), mixed conifer data collected by Sudworth (1900a) on the Sierra Forest Reserve, aerial photographs from1940 and 1944. Using the criteria a subjective assignment of canopy cover range thought to reflect pre-1850 historical forest conditions was made to each combination of forest type (PNV), site quality, slope, and aspect.

The canopy cover range was assigned based in part on the criteria listed below.

1) North aspects were identified with up to twice the tree canopy cover as southwest aspects
2) Areas dominated by rock and thin soils (low site quality) limited stands to “sparse”.
3) Steep slopes are one canopy class lower than gentle slopes.
4) Major drainage bottoms (e.g. Big Creek) are “dense” unless limited by low site quality
5) Ponderosa pine and Jeffrey pine types are “open” unless on north to east aspects on moderate to high site
6) Mixed conifer and white fir stands are “dense” unless on south to southwest aspects
7) Red fir type is “dense” unless limited by low site quality

Along with the criteria listed, needs for old forest linkages, treatment of the WUI and Defensible Fuel Profile Zones (DFPZ) and the information on historical density were taken into consideration in developing a canopy cover range that identifies desired conditions for each type of stand that is displayed in Table 2-1. These canopy ranges limit the intensity of tree removal and identify the desired residual canopy cover used to develop the inversed J-shaped curve. For more information, see Appendix C.

Table 2-1 - Displays the canopy cover for each type of stand that reflects the desired conditions. The desired condition reflects both the pre-1850 conditions and fuels treatments.

WUI Land Allocation	Other Land Allocation	Aspect	Range of Canopy Cover	Pine Cover	Mix-conifer Cover	True Fir Cover
Outside WUI	CSO Home Range Core Area (HRCA)	All aspects	The higher of historical density or 40 %			
Outside WUI	HRCA+ Fisher corridor	All aspects	50-60	50	60	60
Outside WUI	Old Forest Linkage	All aspects	50-60	50	60	60
Outside WUI	Other	All aspects	The higher of historical density or 40 %			
WUI Defense/threat	Old Forest Linkage	All aspects	40-50	40	40	50
WUI Defense/threat	HRCA	All aspects	40-50	40	40	50
WUI Defense/threat	Low site	All aspects	<40	<40	<40	<40
WUI Defense/threat	Other	All aspects	The higher of historical density or 40 %			
WUI	Low site	All aspects	<40	<40	<40	<40
ALL	PAC	ALL	50-100[1]	50	50	50

Both the reforestation groups (i.e. plantations) and the matrix (areas between the reforestation groups) are part of a stand. Reforestation groups would be within certain

[1] Based upon the prescriptions for the California spotted owl study

stands or portions of stands dominated by brush, sparse vegetation, or openings. Reforestation groups would occupy about ten percent of each management unit (not including rock outcrops, meadows, or low-site quality areas) and are generally less than three acres in size each. Regeneration is achieved in groups that are less than 3 acres in size. All trees larger than 35" dbh in reforestation groups would remain. Where trees larger than 35" dbh are absent, then four trees larger than 24" dbh would remain. If no trees larger than 24" dbh are present, no legacy trees would remain within reforestation groups. Treatments proposed for the reforestation groups include planting, thinning, and maintenance. Reforestation groups insure conditions for growing seedlings and the matrix provides growing space for all sizes of trees.

Tree removal in the matrix would accentuate the uneven-aged and patchy character of the existing stands and would provide additional growing space for remaining trees. The young and middle age classes, between 11" dbh and 35" dbh, would be the portion of the residual matrix stocking regulated by the KRP uneven-aged silvicultural strategy which includes use of a specific inversed J-shaped curve. Trees larger than 35" dbh would be maintained. Trees in excess of the inversed J-shaped curve and less than 35" dbh would be considered for harvest. Trees that remain by implementation of the KRP uneven-aged silvicultural strategy would be selected on their ability to make use of growing space, protect nest trees, provide bank stability, reduce horizontal and vertical fuel continuity, and restore historical species composition. See Figure 2-1 for an illustration of the inversed J-shaped curve in a mixed conifer stand and the desired trees per acre by diameter class for trees 11" and greater in diameter and trees above or below the inversed J-shaped curve.

Reforestation of brush fields larger than three acres in size necessitate creating a diverse forest structure with at least three age classes. To accomplish this objective, reforestation in brush fields would involve at least three plantings over 20 years and variation in pre-commercial thinning to create diversity mostly in the tree size and some diversity in age.

In existing plantations treatments would focus on survival and accelerating tree growth. Hand, mechanical, and chemical release would remove brush competition and thinning would provide additional growing space. In plantations older than 25 years the KRP uneven-aged silvicultural strategy would create additional age classes by establishing reforestation groups and using interplanting.

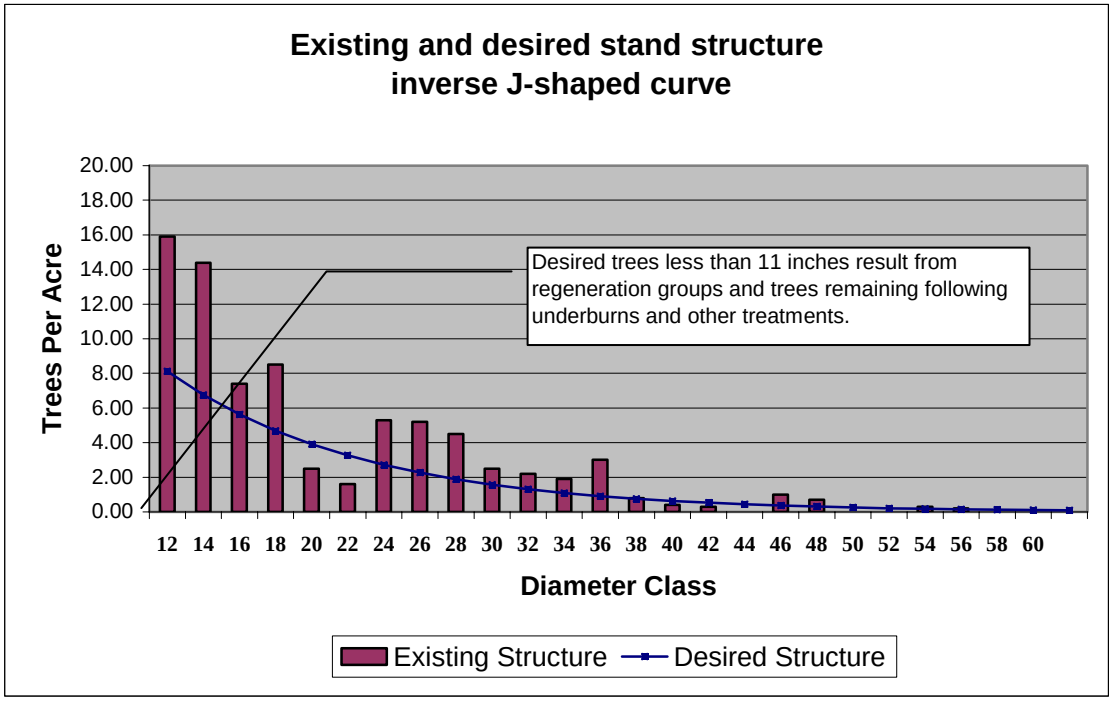

Figure 2-1 - Trees/acre desired condition - Typical inversed J-shaped curve for a mixed conifer stand at the 50% canopy cover in the Krew_prv_1 management unit

To implement the KRP uneven-aged silvicultural strategy, four methods are considered (mechanical, hand, prescribed fire and chemical). Mechanical methods include tractor logging, helicopter logging, mechanical harvesters, grapple piling, and shredder/masticators. Hand methods include planting, cutting brush and trees with chainsaws, hand piling, and hoeing weeds and brush. Chemical methods include the use of glyphosate (the active chemical in Roundup) and a mild surfactant (R-11) to prepare regeneration areas for planting and to control competing vegetation where hand treatments are not effective. Application would be by hand methods (backpack sprayer). Application of glyphosate where bear clover, greenleaf manzanita or similar aggressive sprouting species occur in the reforestation groups would control these species and assure successful reforestation. Application of glyphosate and hand pulling of noxious weeds will also occur to prevent their spread into newly disturbed soil and to prevent them from interfering with reforestation.

Within the stands for the CSOS there are specific treatments for CSO PAC and their activity centers. Treatments in PACs are focused on management direction for the defense zone of the WUI from the 2001 Sierra Nevada Forest Plan Amendment Record of Decision (SNFPA ROD). The SNFPA ROD prescribes a thinning from below that includes design measures that prohibit mechanical treatments within 500 feet of CSO activity centers. Within activity centers, trees less than 6” dbh will be hand cut. Outside the activity center, within a PAC, thinning will be limited to trees less than 20” dbh. Where plantations occur within a CSOS PAC trees less than 10” dbh will be thinned. Tree removal will retain 50% canopy cover across the stand excluding rock and low site. Thin trees less than 6” dbh in stands with canopy cover between 40-50%. Canopy cover reduction will be limited to 20% of existing canopy cover. Mechanical treatments will be limited to 75% of the stand in PACs.

Prescribed fire is the use of fire to remove hazardous vegetation, down woody debris and young trees and brush. The term prescribed fire includes pile burning (both hand and machine created piles) broadcast burning and underburning. The use of prescribed fire should reduce the fuel hazard to assist in restoring the historical pre-1850 forest. Low to moderate intensity fire would consume and kill small trees and brush in the understory (commonly called "underburning"). Underburning would help create the uneven-aged stand structure and maintain desired fuels conditions. Higher intensity fire (often called "broadcast burning" when fire is used in brush fields) would kill brush and create openings for regeneration. Broadcast burning in chaparral dominated areas would create a mosaic of vegetation age classes.

Prescribed underburns are planned as a fuels treatment alone and in combination with the KRP uneven-aged silvicultural strategy, the thinning from below within CSOS stands, the KREW study, and other fuels reduction treatments. Prescribed underburns are coordinated with reforestation activities. Firelines are constructed around reforestation groups and existing plantations. Underburns are excluded from plantations until the crowns lift from the forest floor and the bark is then thick enough to protect the trees from low intensity fire. This condition occurs when trees reach a height of 15 feet in 15 to 25 years.

Underburns would be conducted over large areas on a rotational basis during various seasons of the year and under various prescriptions dependent upon ecosystem objectives. The large area prescribed underburns may be as small as 100 acres or as large as 2000 acres dependent upon topography, climate, and natural barriers. The first underburn entry is a low intensity fire, designed to top-kill the brush and sapling understory and to consume woody debris. Top killing would girdle the plants without consuming them; they die, fall to the ground, and become down and dead woody material. The second underburn entry is a low to moderate intensity fire conducted 4 to 7 years after the first entry, intended to kill any new sprouts and to consume the skeletons of the brush and trees killed in the first entry. The third entry is conducted 10 -13 years later and is a maintenance burn, intended to consume any new fuels or brush. Maintenance burns may then be proposed on a 10 to 20 year rotation under separate National Environmental Policy Act (NEPA) decisions.

Three defensible fuel profile zones (DFPZ) are planned in the KRP area. The size and location of each DFPZ is planned strategically to respond to the historical fire occurrence dating to 1910. These DFPZ will be created on an entire stand basis. The single storied stand approach of the KRP uneven-aged silvicultural strategy would be applied. The DFPZ would serve as control points for fire suppression activities in the event of a wildfire. A combination of treatments, primarily timber harvest, hand thinning, tractor piling, mastication and underburning would be used to create the DFPZ. Previously completed DFPZ show very little undesired vegetation regrowth (10S18 Project) five years after initial treatments. The desired condition of the KRP DFPZ would be maintained with a combination of hand thinning, tractor piling and underburning and could begin 2-4 years (as needed) after initial treatment with planned re-evaluation every two years.

Glyphosate would be applied by hand methods where bear clover, greenleaf manzanita or similar aggressive sprouting species occur in the reforestation groups or existing plantations where tree survival is threatened in order to control these species and assure

successful reforestation. Noxious weed infestations will be treated by glyphosate, hand-pulling, or mechanical methods as described under "application of the proposed action" for each unit below.

Watershed restoration would be implemented at the high and moderate priority Watershed Improvement Needs (WIN) sites in sub-watersheds that exceed their lower threshold of concern (TOC) for cumulative watershed effects. WIN sites included in this Final EIS are found in bear_fen_6; prov_1; prov_4, and n_soapro_2. Other WIN sites exist in the initial eight management units and the KRP area but are not included in this Final EIS for various reasons; they will be addressed on a case by case basis. Additional details about the watershed restoration projects are contained in the watershed restoration plans for Bear Meadow Creek, n_soapro_2, and providen_1 and providen_4, in the project file. These projects are described in Table 13, and displayed on maps in Appendix F.

Application of the Proposed Action

Management Units - The proposed action would change the forest by applying the KRP uneven-aged silvicultural strategy (Appendix C) to create different stands, and by periodically underburning substantial parts of the forest. As described above, some stands would be single storied; others two or three storied and both would contain natural openings, young reforestation groups, various middle-aged groups, and large trees.

See Tables 2-2 to 2-13 below for specific information regarding treatments by management unit. A description of treatments by type (Appendix E), maps (Appendix F), a detailed description of each stand (project record) and details of treatment prescriptions (Appendix E) provide more information on each of the 145 stands in the management units described briefly below. All planned fuel treatments and control lines may be adjusted based on local weather conditions and topography.

Bear_fen_6 Management Unit is 2,205 acres with 19 stands located in T.10S., R.26 E., Sections 32 & 33; T.11S., R.26E., Sections 4, 5, 6, 7, 8, 9, and 17. It lies between 4,500 and 6,500 feet in elevation. Moderate and dense mixed conifer stands dominated mostly with 60 to 120 year old trees. White fir has encroached in the understory of many stands and ponderosa pine dominates the prescribed fire treated stands with incense cedar, sugar pine, and black oak scattered throughout. Currently there is a high risk for insect attack based on the tree density within the stands. Open stands are the result of insect mortality, low site productivity, and past fires. Bear clover and deer brush dominate the openings. Interior live oak and canyon live oak dominate the oak stands. Eleven of the stands are uneven-aged silvicultural strategy and eight are CSOS stands. Fourteen stands of this management unit would have prescribed underburning and three stands would be treated as part of the Bear Fence DFPZ.

Four infestations of bull thistle would be treated with glyphosate, and an additional infestation would be hand-pulled within 100 feet of Oak Flat Creek, and sprayed outside this zone. One infestation each of Klamathweed and cheat grass would be sprayed. Spanish broom along Oak Flat Creek at Road 10S67 would be manually removed. Total acreage of noxious weeds is less than 10 acres. Nine WIN sites will be stabilized.

El_o_win_1 Management Unit is 1,357 acres with 16 stands located in T.10S, R.26 E.; Sections 16, 17, 19, 20, 21, 28 & 29. It lies between 5,400 and 6,400 feet in elevation, is

entirely within the defense and threat zones of the WUI, and is a priority management unit for treatment as identified in the Healthy Forest Initiative, the Healthy Forest Restoration Act and the SNFPA Supplemental EIS (SEIS) ROD 2004. Most of the stands are adjacent to private recreation residences and youth camps. Stand structure is dense mixed conifer vegetation with white fir dominating; ponderosa pine, sugar pine, and incense cedar as well. Open stands are the result of previous timber harvests. The understory contains whitethorn and green leaf manzanita. Fourteen stands have uneven-aged silvicultural strategy treatments and there are two CSOS stands. Nine stands in this management unit would have prescribed underburn treatments. Two small bull thistle infestations would be treated with glyphosate; one is partially within the streamside management zone, and this portion would be hand-pulled. The woolly mullein occurrence near Dinkey Pack Station would be hand-pulled.

Glen_mdw_1 Management Unit is 1,618 acres with 20 stands located in T.10S, R 26E, Sections 5, 6, 7, 8, 17, 18 & 20. It lies between 5,600 and 6,800 feet in elevation, is entirely within the defense and threat zones of the WUI, and is a priority management unit for treatment as identified in the Healthy Forest Initiative, the Healthy Forest Restoration Act and the SEIS ROD 2004. This management unit contains CSOS study stands. The stands surround the Dinkey Creek campground, Dinkey Creek Ranger Station, and several recreation residences and youth camps. The stands are composed of mixed conifer dominated by white fir and Jeffrey pine scattered with large pre-dominant trees (>250 years old) and dense pockets of middle story and understory pine and fir species. These middle story and understory pockets are the result of the encroachment of fir and pine after the harvest of the early 1920's. Open stands are the result of low site quality or shelterwood harvests from the late 1980's. Fifteen stands are uneven-aged silvicultural strategy treatments, four stands are CSOS, and one is untreated. The infestation of lens-podded hoary cress near Dinkey Pack Station will be sprayed, one infestation each of bull thistle and cheatgrass will be sprayed, and two bull thistle infestations that occur near streams will be hand-pulled.

Krew_bul_1 Management Unit is 1,195 acres with 9 stands located in T.11S., R.26 E., Sections 12 & 13; T.11S., R.27E., Sections 7, 8, 17, 18, 19 & 20. It lies between 7,100 and 8,200 feet in elevation. This management unit is composed of mixed conifer and red fir with scattered Jeffrey pine. Sugar pine and incense cedar are at the lower elevations. Many stands contain meadows and lodgepole pine. Mountain whitethorn and green leaf manzanita dominate the openings. This management unit contains the Kings River Experimental Watersheds (KREW) study. Some stands within the management unit fall outside the experimental watershed while other stands fall both within and outside the experimental watershed. The no treatment-control area for this section of the KREW study is located within the Teakettle Watershed directly to the east of the Krew_bul_1 management unit. Nine stands are uneven-aged silvicultural strategy treatments. Six stands are scheduled for prescribed underburn treatments. Additional study information is described below. No noxious weeds were found in this unit.

Krew_prv_1 Management Unit is 1,898 acres with 21 stands located in T.10S, R 25E, Sections 12, 13, 14, 23, 24 & 26. It lies between 4,100 and 6,700 feet in elevation is entirely within the defense and threat zones of the WUI, and is a priority management unit for treatment as identified in the Healthy Forest Initiative, the Healthy Forest Restoration Act and the SEIS ROD 2004. Within the KREW study area, there are also

479 acres of privately owned land by Southern California Edison. Southern California Edison has agreed to include similar treatments on their adjacent lands as a cooperator. It has 60 to 120 year old white fir and incense cedar dominated in mixed conifer stands. Large older trees (> 200 years) are scattered across the management unit with dense ponderosa pine stands at the lower elevations. Most of which were planted following the 1947 Bretz fire. Open stands are the result of previous harvests and insect mortality. Sixteen stands are uneven-aged silvicultural strategy treatments, three stands are CSOS, and two are research controls. Seven stands are scheduled for prescribed underburn treatments. Seven stands contain DFPZ. Additional study information is described below in this chapter. Two small bull thistle infestations would be sprayed in this unit, and two would be hand-pulled (they are either near water or in the Control portion of the study area).

N_soapro_2 Management Unit is 2,420 acres with 26 stands located in T.10S, R 25E, Sections 29, 30, 31, 32 & 33; T.11S., R.25E., Sections 4, 5, 6, 7, 8 & 9. It lies between 2,400 and 4,400 feet in elevation. Eighteen stands are within the threat and defense zones of the WUI, qualifying this management unit as a priority treatment unit as identified in the Healthy Forest Initiative, the Healthy Forest Restoration Act and the SEIS ROD 2004. Ponderosa pine, live oaks and chaparral dominate this unit. At the turn of the 19th century, harvest pressure was intensified leaving behind stands of ponderosa pine with a dense understory of white leaf manzanita and bear clover. Live oak dominates the oak stands with various brush species as the understory. A known site of the noxious weed tocalote, *Centaurea melitensis,* exists within the unit and is identified here for treatment with glyphosate. This population is too large for effective hand pulling. Without chemical treatment, it would pose a greater risk of spreading within the n_soapro_2 unit. The site is below Soaproot Saddle, west of forest road 10S04 and is approximately 3600 square feet in size. Fifteen stands are uneven-aged silvicultural strategy treatments, three stands are CSOS and eight no-treatment stands. One stand is scheduled for prescribed underburn treatments and two stands for broadcast burning of chaparral. An infestation of foxglove will be hand pulled in Rush Creek.

Providen_1 Management Unit is 2,015 acres with 26 stands located in T.10S, R 25E, Sections 9, 10, 11, 14, 15, 16, 21, 22 & 23. It lies between 3,600 and 5,900 feet in elevation, is entirely within the defense and threat zones of the WUI, and is a priority management unit for treatment, as identified in the Healthy Forest Initiative, the Healthy Forest Restoration Act and the SEIS ROD 2004. The management unit is a mosaic of ponderosa pine, black oak, and brush fields, a result of the 1947 Bretz fire. Ponderosa pine is dense in pockets. Oaks are on steeper slopes with brush fields dominated by deer brush and white leaf manzanita. Twenty-one stands are uneven-aged silvicultural strategy treatments and five stands are CSOS. One stand is scheduled for prescribed underburn treatments. One stand contains a DFPZ. Three infestations of bull thistle will be treated with glyphosate, and two will be hand-pulled.

Providen_4 Management Unit is 1,049 acres with eight stands located in T.10S, R 25E, Sections 21, 22, 25, 26, 27, 28, 34, 35 & 36. It lies between 3,200 and 5,900 feet in elevation. Six stands are within the threat and defense zones of the WUI, qualifying this management unit as a priority treatment unit as identified in the Healthy Forest Initiative, the Healthy Forest Restoration Act and the SEIS ROD 2004. This management unit is similar to providen_1 management unit with a mosaic of ponderosa pine, black oak, and

brush fields. The 1947 Bretz fire burned within and affected it. Reforestation occurred following the 1947 fire and ponderosa pine is dense in pockets. Oaks are on steeper slopes with brush fields dominated by deer brush and white leaf manzanita. Chaparral and live oak dominate one stand (# 957). Uneven-aged silvicultural strategy is planned for all eight stands. Five stands will be underburned. Five stands are treated as part of the Providence DFPZ. One bull thistle infestation will be treated with glyphosate, and the Spanish broom along road 10S18 will be manually removed.

Table 2-2 - Acres of Commercial Harvest

MANAGEMENT UNIT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
Commercial Harvest	738	350	793	659	1096	1985	1294	693	7608
No Commercial Harvest	1467	1006	826	535	895	433	720	355	6239
Grand Total	2205	1357	1618	1195	1991	2419	2014	1049	13847

Table 2-3 - Harvest System Acres

MANAGEMENT UNIT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
Helicopter	773	61	0	0	183	27	488	519	2051
none	135	230	439	587	874	1071	329	432	4096
Tractor Bunch for Helicopter Logging	0	0	0	0	0	0	25	0	25
Tractor	1297	1066	1180	608	934	1321	1173	98	7675
Grand Total	2205	1357	1618	1195	1991	2419	2014	1049	13847

Table 2-4 - Harvest Prescriptions acres

MANAGEMENT UNIT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
California Spotted Owl Study, Thin less than 6"	109	18	236	0	23	57	176	0	619
California Spotted Owl Study, Thin less than 20"	677	252	0	0	226	92	61	0	1308
California Spotted Owl Study, Thin less than 10"	119	0	2	0	45	0	0	0	165
No Harvest	277	217	477	458	812	1770	927	662	5601
Uneven-aged Management Strategy - plantation	88	27	0	14	13	23	14	0	179
Uneven-aged Management Strategy Upper Diameter Limit 35"	935	842	903	723	872	477	836	387	5975
Grand Total	2205	1357	1618	1195	1991	2419	2014	1049	13847

Table 2-5 - Herbicide Use (Glyphosate & Surfactant) acres

Management Unit	**bear_fen_6**	**el_o_win_1**	**glen_mdw_1**	**krew_bul_1**	**krew_prv_1**	**n_soapro_2**	**providen_1**	**providen_4**	**Grand Total**
Reforestation Groups Chemical Release 1 Application	30	34	15	49	21	0	0	0	149
Reforestation Groups Chemical Release 2 Application	83	38	45	0	30	37	91	32	356
Reforestation Groups Chemical Release 2+ Application	0	0	0	0	0	15	34	20	68
Noxious Weed chemical Spray	9	1	4	0	1	1	2	12	29
Noxious Weed Chemical Spray and Hand Pull	5	1	0	0	0	0	0	1	6
Noxious Weed Chemical Spray and Weed Wrench	1	0	0	0	0	0	0	0	1
Plantation Chemical Release 2 Application	6	0	0	112	65	25	0	0	208
Plantation Chemical Release 1 Application	0	0	0	0	0	43	124	0	166
Plantation Chemical Site Preparation for Planting	0	0	0	0	33	43	124	0	199
Management Unit subtotal Chemical treatment	134	74	63	161	148	164	374	65	1183
Total Management Unit Acres	2205	1357	1618	1195	1991	2419	2014	1049	13847

Table 2-6 - Reforestation and Hand Release Summary acres

MANAGEMENT UNIT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
Noxious Weed hand Pull Only	0	0	1	0	1	1	1	0	3
Reforestation Group Acres	115	85	65	59	50	62	125	52	613
Reforestation Group Site Preparation, Tractor Pile	59	63	59	59	48	61	92	0	441
Reforestation Group Site Preparation, Mastication	5	21	11	0	10	14	40	17	118
Reforestation Group Site Preparation, Hand Pile	50	2	0	10	2	0	32	35	131
Reforestation Group Hand Release 1 Application	54	12	10	0	2	0	11	0	89
Reforestation Group Hand Release 2 Application	30	65	11	59	21	0	19	0	205
Reforestation Group Burn Piles	81	71	59	59	49	61	115	0	494
Reforestation Group Plant	109	76	59	59	49	61	117	52	581
Reforestation Group Replant	14	43	0	49	24	28	20	10	188
Reforestation Group Thin and Remove Damaged Small Trees	114	50	50	59	39	16	74	35	437

Table 2-7 - Plantation Maintenance acres,

MANAGEMENT UNIT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
Plantation Masticate Brush and Thin small trees	64	0	0	136	91	73	57	0	422
Plantation Mechanical Thin small trees	127	0	0	14	13	24	55	0	232
Plantation Hand Thin small trees	207	89	3	0	144	137	41	9	629
Plantation Tractor Pile brush and slash	0	0	0	0	21	0	0	0	21
Plantation Release Hand cut brush	0	97	2	0	0	0	0	0	99
Replant seedlings in existing plantations	0	0	0	0	33	43	124	0	199

Table 2-8 - Fuel Treatment by Acres; Fireline by Miles

MANAGEMENT UNIT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
Crush brush	0	0	0	0	0	136	0	0	136
Grossyard	0	0	0	0	28	0	289	0	316
Hand pile	44	34	168	0	142	15	17	0	420
Lop & Scatter	1275	452	0	340	461	83	50	487	3149
Mastication	353	192	0	136	93	138	117	0	1031
Tractor pile	301	489	1025	270	473	646	808	60	4072
none	232	189	425	449	794	1400	733	501	4722
Grand Total	2205	1357	1618	1195	1991	2419	2014	1049	13847
Miles of Fire Line	0.0	0.3	0.0	0.2	0.7	0.6	0.0	0.4	2.2

Table 2-9 - Fuel Burn Summary, DFPZ, and WUI acres

MANAGEMENT UNIT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
Broadcast burn	0	0	0	0	0	146	0	0	146
Burn hand and tractor piles	345	523	1193	270	614	661	825	60	4491
Jack pot burn concentrations of slash	0	0	0	0	0	63	76	0	139
Underburn	1569	733	0	831	795	194	10	554	4685
Grand Total	1914	1256	1193	1100	1408	1063	912	614	9461
DFPZ created	394	0	0	0	586	0	88	797	1865
WUI Defense treated	0	482	580	0	222	39	135	669	2127
WUI Threat treated	0	820	967	0	1674	1565	1879	51	6956
Outside WUI	2205	54	71	1195	95	815	0	329	4764
Management Unit Grand Total	2205	1357	1618	1195	1991	2419	2014	1049	13847

Table 2-10 - Road Summary

MANAGEMENT UNIT	Bear fen 6	El o win 1	Glen mdw 1	Krew bul 1	Krew prv 1	N_soapro_2	Providen_1	Providen_4	Grand Total
Year of Implementation	2007	2007	2006	2007	2006	2008	2006	2006	
Miles of Road Maintenance	41.5	23.9	24.2	22.2	23.5	12.9	23.4	19.1	190.7
Miles of Road Reconstruction	16.5	12.4	12.2	10.8	14.1	4.3	7.6	6.8	84.7
Miles of New Road Construction	0	0	0	0.2	0.9	0	0.6	0	1.7
Project Construction Costs(1000s dollars)	$301	$135	$262	$163	$441	$306	$202	$189	$2,000

Table 2-11 - Acres of the CSO PAC, HCRA, and Adjacent Stand Areas

MANAGEMENT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
Non KREW Study	2205	1357	1618	0	876	2419	2014	1049	11537
Adjacent Stand Acres	328	711	838	1195	1666	1419	1231	1049	8437
Protected Activity Center	1036	317	298	0	254	328	369	0	2601
Grand Total	2205	1357	1618	1195	1991	2419	2014	1049	13847

Table 2-12 - Acres of the KREW in the Initial Eight management Units

MANAGEMENT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
Non KREW Study	2205	1357	1618	0	876	2419	2014	1049	11537
KREW Study	0	0	0	1195	1115	0	0	0	2310
Grand Total	2205	1357	1618	1195	1991	2419	2014	1049	13847

Table 2-13 – Watershed Restoration Projects

Management Unit	Sub-watershed	Map #	Description	Proposed Repair
providen_1	519.0057	54431	4 ft. headcut in meadow	Stabilize with geotextile and rock
		54433	Gullies initiating from old skid trail with failing waterbars	Fill gullies and repair waterbars
		54434	Gullied skid trail	Fill gully and subsoil surface, install waterbars
		54435	Gullied skid trail, possible sedimentation into stream	Fill gully and repair waterbars
		54436	Debris slide associated with road 10S75	Design by Road Engineer
		54447	Old skid trail with unauthorized OHV[2] use; gullies; sedimentation into streams	Either mitigate sedimentation or close, subsoil and install waterbars.
		54438		
		54439		
		54440		
n_soapro_2	519.3053	54136	Bank erosion and channel downcutting; slash in channel	Remove slash form channel. Evaluate cause of downcutting. Stabilize banks if indicated.
			Undermined culvert on 10S02; erosion on 10S02D	Coordinate with Engineering
		54137	Actively eroding gully from non-system road	Evaluate road; either mitigate erosion by improving drainage or close and rehabilitate route.
		54138 54274	Erosion from OHV trail (extension of 10S43) contributes sediment to Rush Creek	Evaluate route; either mitigate erosion or close and rehabilitate route.

[2] Off-Highway Vehicle (OHV)

Management Unit	Sub-watershed	Map #	Description	Proposed Repair
bear_fen_6	520.1051	54401	Drainage and erosion problems including gullies on closed road	Improve drainage. Maintain culverts, or remove culverts and reshape stream geometry.
		54402		
		54403		
		54404		
		54405	Failed stream crossing, gullies and erosion.	Reshape slope and stream channel. Mulch and seed slope
		54416	Active headcut creates sedimentation at downstream culvert.	Stabilize with geotextile and rock.
		54417	Stream flow is captured by old skid trail – gullies.	Return flow to channel, and restore geometry of stream channel. Subsoil skid trail, mulch, waterbar.
		54419	Headcut and gully initiating on a skid trail and affecting a landing.	Rip and waterbar skid trail. Repair headcut wit filter fabric and rock. Revegetate gully with native species.
		54420	Gully below road drainage culvert.	Reposition culvert away from gully to remove concentrated flow – rock new outlet location to prevent gullying. Reshape gully headcut and stabilize with filter fabric and rock. Revegetate with native species.

Research

Ecosystem-scale experiments are an important step in the extrapolation of ecological knowledge to the understanding and management of whole ecosystems (Schindler 1998). The Kings River Project area is large enough to potentially allow replication of certain experiments and represents the heterogeneity of southern Sierra ecosystem types. Research study areas range in size from localized small plots to small watersheds and landscapes depending on the species or process studied.

Concern has been raised that the research is following rather than leading the management activities. The Kings River Project was originally conceived as a management hypothesis: Will implementation of a landscape strategy such as the KRP uneven-aged silvicultural strategy combined with prescribed fire be able to restore forests to the historical pre-1850, fire resilient condition? This hypothesis is at the heart of the management experiment and drives all facets of the Project. Thus, the research that has been developed to support this management experiment is necessarily following the intended management activities. All planned research has been conceived to examine the response of the ecological system to the set of management prescriptions meant to implement the overall vegetation management strategy. The design of the proposed action has been an iterative and collaborative process between management and research over several years. Research needs have driven some aspects while practical considerations and management needs have driven others. PSW intends to provide scientific feedback on the effects of the treatments, metered out over space and time, on particular features of interest (e.g. chemical/biological elements of watersheds, key sensitive species).

The KRP provides the opportunity for additional studies through time. For example, the Kings River Project is now the Forest Service's western site for evaluating air pollution effects on forest ecosystems. We will continue to provide opportunities for additional research within the overall framework of the Kings River Project as opportunities present themselves.

Kings River Experimental Watershed (KREW)

The purpose of the Kings River Experimental Watershed (KREW) study is to quantify the existing condition and variability of, and to evaluate the effects of the implementation of the KRP on, the characteristics of headwater stream ecosystems and their associated watersheds. Selected measurements for evaluation include, stream discharge and water quality, soil condition, nutrient budgets, sediment budget, stream food web and/or energy budget, geomorphic processes, vegetation and fuel loading characteristics of upland and riparian areas. The design of the KREW study is for a minimum of 15 years with placement of instrumentation in 2000 and data collection that started in 2002. Treatments associated with the KREW study are designed to meet the 2004 SNFPA.

Specific questions that the KREW study will address were identified in the 2001 SNFPA Final EIS (FEIS), Appendix E:

- What is the effect of fire and fuel reduction treatments (i.e. thinning of trees) on the riparian and stream physical, chemical, and biological conditions?
- Does the use of prescribed fire increase or decrease the rate of erosion (long term versus short term) and effect soil health and productivity?
- How adequate and effective are current stream buffers at protecting aquatic ecosystems?

The stands within the KREW study area would receive different treatment combinations to satisfy the research design given the forest condition. A list of the variations follows:

- Twelve stands would have underburn treatments only
- Twelve stands would have the KRP uneven-aged silvicultural strategy and underburn treatments
- Twenty two stands would have the KRP uneven-aged silvicultural strategy and tractor pile treatments
- One stand would have the KRP uneven-aged silvicultural strategy and gross yard
- Two stands are controls.
- Four stands would have hand pre-commercial thinning and tractor piling only.

California Spotted Owl Study (CSOS)

The primary purpose of the CSOS is to gain knowledge regarding the effects of fuels and vegetation management on California spotted owls and their habitat. This information addresses conservation and management objectives, particularly in this case as it pertains to management of forests in the southern Sierra Nevada. To assess acute effects on California spotted owls, radio telemetry[3] would be used to track the movements and

[3] Use of radio telemetry will require additional funding that is currently not yet identified.

behavior of individuals. Existing demographic data would be related to vegetation and mapped to improve the understanding and the relationship between vegetation patterns and survival and reproduction. Treatments would occur within protected activity centers (PACs), Home Range Core Areas (HRCA) (FR039; FR119; FR122; FR130; FR160; FR161; FR162; FR167), and adjacent habitat with the proposed action.

A Protected Activity Center (PAC) is an area that is the best available occupied habitat by a California spotted owl and used for nesting and roosting. A PAC is approximately 300-acres in size. In 1993, National Forests delineated PACs surrounding each territorial owl activity center detected on National Forests System lands since 1986. Owl activity centers are designated for all territorial owls based on: (1) the most recent documented nest site, (2) the most recent known roost site when a nest location remains unknown, and (3) a central point based on repeated daytime detections when neither nest or roost locations are known. A HRCA surrounds each territorial spotted owl activity center detected after 1986. Core areas encompass the best available California spotted owl habitat in the closest proximity to the owl activity center (USDA 2004).

Within the stands for the CSOS there are specific treatments for CSO PACs and their activity centers. Treatments in PACs are focused on management direction for the defense zone of the WUI from the 2001 SNFPA ROD. The SNFPA ROD prescribes a thinning from below that includes design measures that prohibit mechanical treatments within 500 feet of CSO activity centers. Within activity centers, trees less than 6" dbh will be hand cut. Outside the activity center, within a PAC, thinning will be limited to trees less than 20" dbh. Where plantations occur within a CSOS PAC trees less than 10" dbh will be thinned. Tree removal will retain 50% canopy cover across the stand excluding rock and low site. Thin trees less than 6" dbh in stands with canopy cover between 40-50%. Canopy cover reduction will be limited to 20% of existing canopy cover. Mechanical treatments will be limited to 75% of the stand in PACs.

Refer to Tables 2-2 through 2-13 in this chapter for acres of treatment by management unit.

Outside of PACs, treatments would focus on implementation of the KRP Uneven-aged silvicultural strategy on 26 stands including the following:

- Five stands would have underburn
- Twenty stands would have tractor pile
- One stand would have gross yard/new technology

There are twenty-four stands within PACs where the defense zone prescription described previously would be applied including the following:

- Four stands would have underburn
- Two stands would have underburn and tractor pile
- Fifteen stands would have tractor pile
- Two stands would have gross yard/new technology
- One stand would have hand pile

Fisher Study

A primary information need cited in the Sierra Nevada Forest Plan Amendment Adaptive Management Strategy is "to understand the direct effects of treatments on the fisher population demographics, behavior of fisher, and on the habitat choices they make when confronted with landscapes that have been modified to reduce the severity of fire". The pacific fisher is currently a candidate for listing under the Endangered Species Act and, as such, there is significant concern over the long-term status of this species in the Sierra Nevada. The ultimate and proximate limiting factors affecting this population are largely unknown. The role of habitat is one factor that is suspected to have an influence on population performance. Over the last few years the Forest Service has attempted to address two important issues; 1) Develop a baseline assessment of basic fisher conservation requirements including available habitat throughout the current range in the Sierra Nevada, and 2) Develop research strategies to examine questions addressing how fishers use habitat, how they respond to changes in habitat, and what the limiting factors are that influence population performance. It is clear that the latter (i.e. research) is necessary to inform the former (i.e. construction of an informed and defensible long-term conservation strategy).

Given the status of fisher and history of fisher research in the Kings River area, combined with the proposed action to implement an uneven-aged silvicultural strategy, there has long been interest in pursuing fisher research in the Kings River area. The Forest Service, through collaboration between the Sierra National Forest and the Pacific Southwest Research Station, has been exploring what can and should be learned as a result of the proposed treatments as well as what we need to learn about fishers in general.

Simultaneously, the Forest Service has been collaborating with the California Resources Agency and the U.S. Fish and Wildlife Service to develop an adaptive management program under the leadership of a third party, the University of California. In the course of this work research on fisher has emerged as the highest priority for determining response of sensitive wildlife species to fuels treatments in the Sierra. This has led to formulation of a research proposal on fisher that would address both objectives; the Kings River Project and the Sierra Nevada Adaptive Management and Monitoring Project. The primary objective of this proposed fisher study is to obtain measurements of habitat use, survival, reproduction, and dispersal for fishers living in a study area subject to a spectrum of vegetation treatments, timber harvest, and natural disturbance events. Specific questions to be answered include:

- What are the population size and structure (males, females, young) of fishers in the study area?
- What are the vital rates of this population? This includes birth rates, death rates, and dispersal rates.
- What are the causes of mortality?
- What are the patterns of habitat use? What types of areas within home ranges receive disproportionately greater and lesser use? Is there significant avoidance of areas that are mechanically thinned? If so, for how long after treatment does this behavior persist? How do fishers respond to wildfire and how do they use

areas that have been affected by wildfire? What value do the least-affected areas within the perimeter of a wildfire have to fishers?

- What is the diet of this population, and how do food habits relate to habitat use?
- What are the patterns of dispersal, e.g., distance, direction, survival? Related to this, how are individuals in the population related?

A variety of research approaches have been considered and some pilot studies have been conducted to examine some of these approaches. Fishers are inherently difficult animals to study, particularly when there is interest in determining thresholds in vegetation condition that precipitate changes in their abundance. Fishers have large home ranges and are found at low densities thus sample sizes, even in healthy populations, will be small; traditional experimental designs are difficult or impossible to implement; there is lack of ability to randomly assign treatments and controls; and there is a lack of true controls as sites have different starting conditions due to differing past management history, site conditions, and environmental heterogeneity. Methods such as use of track plates; track plates with hair snaring; camera stations; conventional radiotelemetry; global positioning system (GPS) telemetry; and scat detector dogs have all been evaluated for use in addressing the objectives that we have for this research.

For the Kings River Project we believe it is prudent to adopt an approach that takes advantage of plans to address very similar objectives within the Adaptive Management program being led by the University of California. This UC program intends to understand response of multiple forest resources (including fishers) to forest management treatments. By replicating this research approach on fishers in the Kings River area we can significantly increase our opportunities to learn about these key issues. Thus the Kings River Project intends to apply the same objectives and methods for addressing response of fisher to the treatments executed in the Kings River Project area. These are summarized from the UC proposal and presented below.

Methods for this research will include:

1) **Live-trapping** of fishers to fit them with radio collars and obtain habitat use, reproduction rates, and mortality rates throughout an approximately 60,000 acre study area on an ongoing basis for at least 7 years. The goal is to be able to monitor continuously all fishers in the area and any that may disperse into it or from it. The extent of this study is anticipated to involve approximately 15-20 animals from a total estimated population of something less than 400 animals
2) **Camera traps.** The fisher population will be monitored continuously using bait stations with a remote camera system.
3) **Genetic analyses.** Various techniques will be employed to collect tissue, hair or scat, from traps, hair snares, and with scat detector dogs. Any sample obtained from a fisher will be analyzed to determine the sex and genotype of the animal.
4) **Radio telemetry.** The goal will be to locate each animal on the ground daily. Frequent aerial telemetry will facilitate ground location of animals

when not otherwise easily found from the ground. Carcasses will be collected for necropsy within 24 hr of death if possible.

5) **Habitat relationships.** Attempts will be made to locate the precise structure that a particular animal is in, e.g., live tree, snag, etc. Locations of animals will be recorded with a global positioning device. The structure the animal is in will be identified and measured. The habitat in which the animal is in will also be characterized. If the technology of GPS collars advances sufficiently to allow use on fishers it will yield many more locations and more precise locations, providing much needed data on habitat preferences. Importantly, these data will help describe differences between foraging and resting habitat.

6) **Mortality.** The radio collars will be equipped with mortality sensors, which transmit signal pulses at a different frequency when an animal does not move for a specified period of time (e.g. 6 hours). When this mortality signal is received, researchers will immediately locate the carcass of the animal, attempt to determine the cause of death, and submit the carcass to a qualified wildlife veterinarian for a necropsy.

7) **Natality.** When telemetered females localize their activity to a single structure (i.e., snag, tree or log) in the late-winter/early spring, it can be assumed that they are giving birth there. This presumed natal den (and subsequent maternal den(s) where the female will relocate her dependent young) can be monitored with minimal disturbance. Remote camera stations will document the presence of kits. These will be captured for radiotelemetry when they reach 3 months of age.

8) **Dispersal**. The frequent monitoring of animal locations will produce knowledge of when an animal leaves the study area. It will be located and followed from the air and from the ground in its new home range. Recent research on the Hoopa Indian Reservation has pioneered, quite successfully, PIT-tagging of kits through capture of the kits in the natal den. These kits are then recaptured when they are older and marked with telemetry collars, providing additional important information on dispersal of young.

9) **Diet.** Fisher scats can be obtained using scat sniffing dogs, and incidentally from live traps and den sites. Scats will be analyzed to assess diet.

This research is planned for a seven year period to include both pre-treatment and post-treatment data collection. The study area will encompass approximately 50,000 to 70,000 acres for each study site, depending on where and how many fishers we are able to locate and where individuals move and where young disperse. Our intention is to capture and radio collar every adult animal in the study area. Crews will monitor locations and movements of all animals on a regular basis.

Traditional research design relies upon a statistical paradigm involving replication and randomly assigned treatments and controls. For a species that has relatively large home ranges and is found in low densities on a complex, heterogeneous landscape subject to many kinds of perturbations over recent time, such experimental design is not feasible.

Alternative analytical approaches exist that can lead to the learning necessary from these studies. In the University of California proposal for adaptive management in the Sierra Nevada they identify and recommend an approach where:

> "In our formal estimates of management impact we intend to take a likelihood approach to evaluating our results (Edwards 1992). Instead of the traditional hypothesis testing, we will measure the support in the data for our a priori expectations (i.e., models). An advantage of this approach is the greater relevance of the information gained by evaluating the effect size with estimates of uncertainty rather than a test of null hypotheses. For example, rather than testing the null hypothesis: Do Strategically Placed Landscape Treatments (SPLAT) reduce the fire spread rates in the treated firesheds? We plan to report the difference in the rates of fire spread and quantify the uncertainty in these estimates. This approach is more conducive to an adaptive management framework (Johnson 2002b, Hobbs 2003, Bennett and Adams 2004) in part because it provides more intuitive answers to stakeholders' concerns. For cases where we have competing models to explain the observed responses, we will use information theoretics (e.g., Akaike's information criterion) to quantify the strength of evidence for alternative models (Burnham and Anderson 1998)."

This is an appropriate approach for investigating the kinds of questions that we have identified regarding fisher populations and their selection of habitat. Therefore, data analysis for this research will use such innovative methods to provide adequate quantitative and analytical techniques to address this large-scale study.

Uneven-aged Management Study

An uneven-aged management study has been conceived but will only be implemented to the extent of establishing ten management units as treatment-controls (Appendix C). These controls are intended for use in a future uneven-aged management study and may also be used for other study and monitoring purposes. The uneven-aged management study can not be reasonably implemented utilizing the initial eight management units because two are involved in the KREW Study and several others have significant area in the defense zone of the WUI. These focused activities preclude applying the uneven-aged silvicultural strategy to the extent necessary for this study.

Project Design Measures

Below are the general project design measures incorporated into the Proposed Action (Alternative 1) and the Reduced Harvest Tree Size Alternative (Alternative 3). If a measure is not applicable to an alternative or specific management unit it is noted in the description of the measure. Design measures may be refined using site-specific information during implementation.

Unless otherwise explained in this section, the measures were either adopted from the SNFPA 2004 ROD Appendix A: Management Direction or are one of the remaining operational Land and Resource Management Plan (LRMP) standards and guidelines.

Air Quality (Fuels): The following are Best Available Control Measures (BACM) for prescribed fire as required under section 190 of the Clean Air Act as amended in 1990.

In 1992, The Environmental Protection Agency (EPA) developed implementation strategies and BACM for areas that are designated serious non-attainment for particulate matter greater than 10 microns (PM_{10}).

Specific techniques to reduce fire emissions include:

1) Commonly used reduction techniques such as burning of unit after harvest but before new live fuels appear, burning in the springtime prior to "green-up", burning when 1,000 hour fuels (woody debris larger than 3" in diameter) moistures are high, and burning when the duff is wet (after fall precipitation, or during winter and spring).

2) Avoidance techniques such as burning on cloudy days when the plume and residual smoke cannot be seen, during periods of atmospheric instability for better smoke dispersal, and during periods of low visitor use.

3) Techniques to optimize flaming combustion include: burning of piled fuels rather than broadcast burning, reducing the amount of dirt in piles, and rapid ignition to create a high intensity fire.

4) The Conformity section of the Clean Air Act (CAA) Section 176(c) prohibits federal agencies from permitting, approving, providing financial assistance, or supporting in any way any activity that does not conform to the State Implementation Plan (SIP). A full conformity analysis is required by the CAA and the SIP to assess whether the proposed action produces less than the de minimis emissions. (For full determination refer to the KRP EIS Air Determination available in the project record).

Aquatic Species: Listed below are the general aquatic species and habitat design measures that were in part adopted and developed from the SNFPA 2004 ROD (pages 62 – 66), the Sierra National Forest's Land and Resource Management Plan (USDA 1992), and through formal and informal consultation with the U.S. Fish & Wildlife Service (Sanders 2006a and 2006b;Appendix D).

Project design measures were based on the aquatic species likely to be found in the project area, their life stage(s) that could be affected by the project, the likelihood of dispersal for that species into the project area, the occurrence of suitable habitat for the species in the project area, the type and extent of the project, along with other factors such as the time of year the project could occur.

Throughout pages 62 to 66 of the SNFPA 2004 ROD (USDA 2004a) there is specific direction for providing mitigations for minimizing and avoiding impacts to aquatic species and their habitats. To meet these standards and guidelines mitigation measures were developed into project design measures for the action alternatives of the Kings River Project in 2004 (Sanders 2004).

Some of the original aquatic species design measures were rejected and not incorporated into the proposed action based on conflicts with the particular management unit objectives. In the krew_bul_1 and krew_prv_1 management units the primary objective is the KREW study. Within krew_bul_1 management unit occurs a very unique population of Yosemite toads. An inter-disciplinary review of design measures using the geographical information systems (GIS) project, it became evident that the limited operating period within 0.6 miles of meadows occupied by Yosemite toads would limit

activities on almost the entire krew_bul_1 management unit. The KREW study requires the activities intended to address several questions posed in the SNFPA 2004 Record of Decision to take place in as few years as possible to concentrate the effects in time and provide the greatest opportunity for accomplishing the objectives of the study. Since the KREW study has a structured research design for implementation, this protection measure for Yosemite toads and one specifying no mechanical treatments within 500 feet of the occupied meadows in this management unit were rejected as conflicting with the KREW study objectives (Hunsaker 2004; Hopson and Strand 2004). The latter was replaced with a 100 foot zone specifying no mechanical treatments. If the 100 foot zone were expanded to the 500 foot zone, the effect of the proposed action and the KREW research on the Yosemite Toad would be reduced and some protection for this species in the known occupied meadows would be provided. Additional protection measures for Relictual slender salamanders were also rejected based on the KREW study objectives (Hunsaker 2004; Hopson and Strand 2004).

For Alternative 3 protection measures identified with technical assistance from the U.S. Fish and Wildlife Service (USFWS) (Appendix D) for the Yosemite toad will apply; including the limited operating period within 0.6 miles of occupied meadows.

In two other management units, providen_4 and providen_1, some original protection measures were modified for the California red-legged frog to allow helicopter yarding or endlining from roads in and around the Blue Canyon Work center and campground areas where the WUI overlaps (Porter 2005).

The aquatic species design measures that are listed next were accepted by the District Ranger and do not overlap with those already listed in the hydrology, best management practices, soils, roads, and watershed improvement needs design measures.

Table 2-14 – Riparian Conservation Area (RCA) Widths & Definitions

Stream Type	RCA Width
Perennial Streams	300 feet on each side of the stream, measured from the bank full edge of the stream
Seasonally Flowing Streams (includes ephemeral streams)	150 feet on each side of stream, measured from the bank full edge of the stream
Streams in Inner Gorge	Top of inner gorge
Special Aquatic Features (e.g. fens, bogs, springs, seeps, etc.) or Perennial Streams with Riparian Conditions extending more than 150 feet from edge of streambank or Seasonally Flowing streams with riparian conditions extending more than 50 feet from edge of streambank.	300 feet from edge of feature or riparian vegetation, whichever width is greater
Other hydrological or topographic depressions without a defined channel.	RCA width and protection measures determined through project level analysis

1. Follow all applicable aquatic wildlife species and riparian habitat standards and guidelines from the 2004 Sierra Nevada Forest Plan Amendment, Final Supplemental Impact Statement and Record of Decision (USDA 2004a), the existing Sierra National Forest Land and Resource Management Plan direction (USDA 1992), Forest Service handbook (FSH) 2509.22 Sierra Supplement #1 for treatments within Streamside Management Zones ((SMZ) USDA 1990)), Best Management Practices and other applicable laws and regulations (USDA 2000b). The Riparian Conservation Areas (RCA) are defined in Table 2-14 as well as in Appendix E:
2. Protect any seeps, springs, bogs, fens, and/or wet areas that may be found during project implementation that are not already identified on project analysis maps. Treat these areas as perennial areas with 300 foot RCA.
3. For the California red-legged frog (CRLF; Federally Threatened Species) suitable habitat identified within the n_soapro_2, providen_1, providen_4, and bear_fen_6 management units the following specific protection measures would be applied:
    a. no mechanical treatments year-round within 300 feet of identified CRLF suitable habitat except within providen_1 and providen_4 management units; helicopter yarding or endlining from roads, Blue Canyon Work center and campgrounds would be allowed where the WUI and the CRLF 300 foot buffer coincide
    b. use only water for dust abatement within 300 feet of identified CRLF suitable habitat
    c. no water drafting sites within 300 feet of identified CRLF suitable habitat
    d. a limited operating period from October 1st to June 15th in which no project related activity can occur within 300 feet of identified CRLF suitable habitat
4. Protection measures for the species and habitat of Western pond turtle (Forest Service Sensitive Species) and Relictual slender salamander (Forest Service Sensitive Species) are:
    a. no piling or burning of piles within RCA (not applicable to stands within krew_prv_1 and krew_bul_1 management units)
    b. no ignition of fires within RCA (fires are allowed to creep into RCA) (not applicable to stands within krew_prv_1 and krew_bul_1 management units)
    c. no removal of any riparian vegetation within RCA
    d. no storage of petroleum products within RCA
    e. use only water for dust abatement within RCA
    f. no mechanical treatments within RCA during the wet season (October 1 to June 15) in n_soapro_2, providen_1, providen_4 and krew_prv_1 management units.
5. In addition to the protection measures listed above, for Alternative 1, protection measures for the Yosemite toad located in the krew_bul_1 management unit are:
    a. no treatments of herbicides/pesticides within 500 feet of the occupied meadows;
    b. no water drafting sites located within 0.6 miles of the occupied meadow.

For Alternative 3, additional protection measures identified by the USFWS for Yosemite toad (Appendix D) are:

a. No mechanical treatments within 100 feet of meadows.

b. Trees may be felled within 100 feet of meadows and removed by means of a cable; around meadows used as breeding habitat by Yosemite toads, only trees 50 or more feet away from the meadow will be felled.

c. Within 0.6 miles of occupied meadows, operations will start after breeding is over and end by October 1, and operations will cease for 24 hours after rainfall >0.1 inch.

- meadow occupancy and timing of breeding will be determined annually by aquatic biologist

d. Heavy machinery will be kept at least 50 feet from moist upland habitats where toads are likely to be present during the summer, such as willow and lupine patches, but trees may be felled within this area and removed by means of a cable.

e. No chemical treatments within 500 feet of occupied meadows.

f. No water drafting within 0.6 miles of occupied meadows.

6. General aquatic species and riparian habitat protection measures within all RCA are to:
    a. Do not allow mechanical equipment within 100 feet of meadows or other special aquatic features.
    b. To protect bank stability, do not cut streambank trees (trees with drip line extending to or over edge of streambank).
    c. For water drafting, use a screened intake device and pumps with low entry velocity to minimize removal of aquatic species, including juvenile fish, amphibian egg masses and tadpoles, from aquatic habitats. A Hydrologist and Aquatic Biologist would approve water-drafting sites. See Best Management Practices (BMP) 2-21 in Table 2-15 for specific requirements.
    d. Monitor potential project effects to streams and aquatic habitat using the Region 5 (R5) Stream-Condition Inventory protocols (Frazier and others 2005).
    e. Monitor post project affects to listed aquatic species and their habitats. Seek mitigation measures and replacement habitat if irretrievable loss occurs to habitat or species viability because of project implementation.
    f. When lighting slash piles, start burn from one end only to allow escape route for any species inhabiting piles.

7. Report any discovery of amphibians or reptiles (e.g. frogs, toads, salamanders, and turtles) during project sale preparation and implementation to the District Fisheries / Aquatic Biologist immediately.
8. If newly listed or unknown occurrences of federally listed threatened, endangered, proposed, candidate or Forest Service sensitive aquatic species are found within the affected project area during sale preparation and implementation, additional species

protection measures may need to be imposed by the District Fisheries / Aquatic Biologist.

9. KREW study site instruments (e.g. flumes, instrument houses, etc…) are to be removed at the completion of the study or if it appears funding sources are no longer available to continue the study and the study sites rehabilitated to their pre-project condition (e.g. sediment basins removed and stream channel banks re-stabilized).

Botanical Resources: The following project design measures are for protecting threatened and sensitive plant species and preventing the introduction and spread of noxious weeds within the proposed project area.

1. Avoid impacts to known occurrences of sensitive plants within the Management Units. Known occurrences are shown on maps in GIS.
2. To protect threatened and sensitive plant species that grow in rock outcrops and associated gravel soils:
    a. Do not fell trees or drive equipment or vehicles on rock outcrops or on thin, sandy or gravelly soils.
    b. Consult with a Forest Service botanist before cutting hand line through shallow, gravelly soils.
    c. Do not use herbicides on shallow soils below 3800’ in elevation without prior approval from the botanist (this may require a springtime survey prior to application, at the botanist’s discretion).
    d. Avoid hand thinning of shrubs on rock outcrops or associated gravelly soils between mid-February and July unless approved by the botanist.
    e. Consider these areas occupied by sensitive plants whether the maps in the Biological Evaluation show known occurrences or not. Planning would occur far enough in advance that further surveys can be done and appropriate design measures put in place if project activities use an area of unknown occupancy.
    f. Do not build temporary roads through areas of thin, gravelly soils until plant surveys of the proposed routes are complete, or the botanist has approved the road location.
3. To protect *Carpenteria californica,* ensure that the heavy equipment operator recognizes and avoids *Carpenteria californica* during mastication and tractor piling for work performed in management unit n_soapro_2 and providen_4. Crews doing hand thinning and hand piling would be instructed to recognize and avoid *Carpenteria californica.*
4. During prescribed fire, protect areas of known sensitive plant occurrences below 4500’ in elevation from mid-February through July. For burns conducted February through July in these areas, provide enough lead time for the botanist to be able to conduct pre and post monitoring of sensitive plants in the area (based on botanist's discretion).

5. Follow noxious weed management goals identified in Forest Service Manual (FSM) 2081.2 by the following: Prevent the introduction of new invaders; conduct early treatment of new infestations; contain and control established infestations. To reduce the potential spread of noxious weeds, clean heavy equipment of soil and plant parts before bringing onto the National Forest, and before beginning work in a new management unit, if previously working in an infested unit.
6. After vegetation treatments occur in a unit, survey disturbed areas for noxious weeds for two years post-treatment. If weeds are found, promptly remove to stop seed set. Continue treatment for as long as necessary to eradicate the occurrence(s).
7. Coordinate with botanist prior to layout of final road locations. Allow enough lead time for road corridor survey when required
8. Treat the known noxious weed sites as described in the unit descriptions before disturbing these areas.

Herbicide Use: The following design measures would be applied when herbicides are used in reforestation groups, plantations or noxious weed eradication. They were neither adopted from the SNFPA 2004 ROD Appendix A: Management Direction nor are one of the remaining operational LRMP standards and guidelines. Rather, they were developed and found effective on reforestation projects and noxious weed eradication over the last decade on the District.

1. To protect water quality, glyphosate would not be applied within Streamside Management Zones (SMZs) of flowing streams. It may be applied within 5 feet of dry streams.
2. Glyphosate application would not occur between the first frontal storm system after October 15th and before April 15th that results in greater than ¼ inch of rainfall to minimize impacts to amphibian species.
3. Plants of significance to Native Americans (such as deergrass, sourberry, redbud, elderberry, willow) would be carefully avoided when using glyphosate**.** Additional specific plants or areas could be protected from treatment through consultation with local Native Americans.
4. Elderberry shrubs below 3000 feet would be protected by having a 100 foot no herbicide buffer to protect potential habitat for valley elderberry longhorn beetle.
5. All applicable pesticide laws and label restrictions would be followed to ensure human health and safety (BMP 5.8 and 5.11).
6. To avoid affecting non-target plants and aquatic habitats, application of glyphosate would be stopped when wind speed exceeds 5 miles per hour or as soon as drift is visually observed (BMP 5.13).
7. To help assure no effects occur to human health and safety, all areas treated with glyphosate would be signed warning that herbicide had been applied and that products should not be gathered for food or medicine for 30 days.

Heritage Resources: Project implementation will comply with the stipulations of the *First Amended Regional Programmatic Agreement Among the USDA Forest Service, Pacific Southwest Region, California State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region* (Regional PA), dated 2001 (USDA 2001b). This project meets Stipulations III.C. (2) and III.D.(3)., Undertakings Where Management Measures Are Necessary for the Protection of Historic Properties.

1. Archaeological Heritage Resources: The nature and scope of this project are such that the potential effects to archaeological properties can be reasonably predicted, and appropriate protection measures derived from the Regional PA (Attachment B, and the *Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects*) will be taken to ensure the values of National Register eligible or potentially eligible heritage resources are not affected:

a. Avoid Historic Properties with Ground Disturbing Activities: The nature of the archaeological heritage resources is such that ground disturbance can result in alteration of characteristics that could affect the National Register of Historic Places eligibility of that resource. Archaeological resources will be excluded from proposed project undertaking activities that could result in ground disturbance within their boundaries (i.e. the use of ground-based mechanical equipment, planting, piling, fire-line construction, etc.), in accordance with the Standard Protection Measures (Attachment B) of the Regional PA. Typical implementation of the Standard Protection Measures is the practice of "flag-and-avoid" (Measure I.B.).

b. Allow Certain Non-Ground Disturbing Activities Within Site Boundaries: Certain proposed activities lack the potential to adversely affect the character of historic properties. Implementation of these activities will help reduce the isolation of a site from its surroundings:

i. Archaeological resources may not be resources of interest for prescribed fire (in accordance with the provisions of the *Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects*). The standard resource protection measures of the Interim Protocol will be applied only to those historic properties defined as "at-risk" from the use of prescribed fire treatments.

ii. Mechanical shredding or removal of fuels inside of site boundaries with an articulated boom shredder/harvester will not affect the archaeological materials, provided the tracked or wheeled equipment stays outside of the delineated site boundary and the machine head does not contact the ground surface or site features (Interim protocol, Measure V.B.11.). Removal of fuels by hand (manual thinning with chainsaws) will not affect archaeological materials (Attachment A, II.C.).

iii. Chemical applications for reforestation (treatment of vegetation for site preparation and release) and noxious weed control will not affect historic properties where the application meets the intent of the Regional PA Stipulation III.E, specifically Attachment A, II.E, application of pesticides that do not have the potential to affect access to or use of resources by Native Americans.

2. Non-Archaeological Heritage Resources: Traditional cultural properties, locations of contemporary Native American gathering, and other such cultural resources identified

through consultation with Native American tribes and individuals will be protected through avoidance by project activity, or managed through project implementation and consultation to enhance the resource. For example, planned prescribed fire can have positive effects to regenerate growth in certain plant species used by Native Americans in basketry or traditional food preparation.

3. In the event of inadvertent effects or new discovery during implementation, the Forest will comply with the stipulations of the Regional PA (V.).

Transportation: The criteria below apply for road use and maintenance related to the implementation of either action alternative.

1. Acquire legal access before using any road through private lands.
2. Engineering would provide site-specific recommendations for reconstruction or extraordinary maintenance.
3. New or replacement culverts would be designed to accommodate a $Q^{100\,(4)}$ storm. Consider surface stabilization (distance of 50') at the time. Follow BMP and address specific hydrologic and aquatic species concerns to the extent practicable.
4. Dust abatement would occur as a preventative measure during project activities with the objective of promoting safe use of roads; prevent excessive loss of road material, the prevention of fugitive dust, and the protection of adjacent resources. Use water or other dust palliatives to accomplish dust abatement. Adhere to design measures identified in the Aquatic Resources section above.
5. Road/site conflicts found during field surveys will be addressed with recommendations provided by the District Archeologist. These protection measures will be noted on the engineering road maintenance plans.
6. Early in the design phase an Aquatic Biologist will review locations of temporary roads, culvert installations, and new road construction to determine if additional species conservation measures are needed.

Vegetation: The following design measures for vegetation were developed from experience on the District over the last decade or they come from the LRMP.

1. To provide for oaks for wildlife needs, maintain the 5 to 35 percent of growing space devoted to oaks. Also, maintain all decadent oaks throughout the stand(s) within the limits appropriate for each forest type. Do not remove decadent oaks. Do not prevent over topping of decadent oaks.
2. Ensure that reforestation stocking meets standards described in the LRMP. The release of existing plantations should meet the growth and stocking standards outlined in growth and yield tables (Oliver and Powers 1978).
3. Limit thinning in plantations to periods when slash be less likely to provide Ips species habitat (December to June) to reduce the potential from insect attacks. These dates can be changed based on an evaluation of a certified silviculturist.

[4] Flows of various return intervals are denoted by Qx where Q = flow in cubic feet per second (cfs) and x is = the return interval in years

Soils: The following recommendations are for soil protection.

1. For mechanical treatments, leave a 100-foot wide buffer of 100 percent soil cover below large rock outcrops. These areas have a high potential to generate runoff that can cause accelerated erosion on soils down slope. Prescribed burning will employ firing patterns to maximize cover in these areas.
2. Conduct tractor-piling operations when the soil is sufficiently dry in the top 12 inches to prevent unacceptable loss of soil porosity (compaction). Field checking by a soil scientist would be done to determine if operations could continue under wet soil conditions. Maintain at least 90% of the soil porosity over 15% of an activity area found under natural conditions.
3. Subsoil and water bar skid roads and trails in areas where soils have a high compaction hazard. This includes areas where Holland family soils occur.
4. Limit tractor piling to slopes less than 35%.
5. Maintain 50% soil cover over treatment areas. Where shrub species predominate, attempt crushing before piling to create small woody fragments left scattered over the site for soil cover and erosion protection.
6. Prioritize aggregate surfacing of National Forest System Roads (NFSR), on sensitive soils (soil map units 136, 137, 138, 139, & 140), to sub-watersheds that exceed the TOC.

Watershed: The following measures are for watershed protection and apply to Alternatives 1 and Alternative 3.

1. Implement all BMP described in Table 2-15.

Table 2-15 - Best Management Practices for the KRP

BMP Name, Objective, and Direction	Application to the King's River Project
BMP 1-1 Timber Sale Planning Process: To incorporate water quality and hydrologic considerations into the timber sale planning process.	Implemented through the Riparian Conservation Objectives/Forest Plan Consistency report, specification of operational BMPs, Environmental Analysis including interdisciplinary team office and field discussions, and incorporation of water quality protection measures in the Timber Sale Contract for the KRP EIS.
BMP 1-4 Use of Sale Area Maps (SAM) and/or Project Maps for Designating Water Quality Protection Needs: To ensure recognition and protection of areas related to water quality protection delineated on a SAM or project map.	The sale administrator and purchaser will review these areas on the ground prior to commencement of ground disturbing activities. Examples of water quality protection features that will be designated on the project map include: 1) Location of streamcourses and riparian zones to be protected, including the width of the protection zone for each area. 2) Wetlands (meadows, lakes, springs, etc.) and other sensitive areas (such as shallow soils) to be protected. 3) Boundaries of harvest units, specified roads and roads where hauling activities are prohibited or restricted, areas of different skidding and/or yarding methods, including post-harvest fuels treatments, and water sources available for purchaser's use.
BMP 1-5 Limiting the Operating Period of Timber Sale Activities: To ensure that the purchasers conduct their operations, including erosion control work, road maintenance, and so forth, in a timely manner, within the time frame specified in	The purchaser's contract operation period will be limited to contract-specified periods when adverse environmental effects are not likely. The Sale Administrator will close down operations due to rainy periods, high water, or other adverse operating conditions in order to protect resources.

BMP Name, Objective, and Direction	Application to the King's River Project
the Timber Sale Contract.	
BMP 1-8 Streamside Management Zone Designation: To designate a zone along riparian areas, streams and wetlands that will minimize potential for adverse effects from adjacent management activities. Management activities within these zones are designed to improve riparian values.	Streamside management zones (SMZs) have been supplemented with RMAs and RCAs (USDA 2004b) as described in Appendix E and the Aquatics design measures. Within SMZs, the constraints defined in Sierra Supplement No. 1 (USDA Forest Service, 1989) apply. This includes no self-propelled ground based equipment, a minimum groundcover of 50%, and shade canopy may not be modified in a way that affects stream temperature. Under Alternative 3, harvest in SMZs will follow the SMZ Prescription described in Watershed Design Measure #2 (following this table) to ensure compliance with these constraints. Under Alternative 3, Class I and II streams in sub-watersheds with CWE concerns will have no harvest within SMZs to provide increased protection to these areas. (In helicopter yarding units, the inner 50 feet of the RMA will not be harvested.) Modifications to these guidelines are possible where site-specific needs exist if the action is reviewed by a hydrologist or fisheries biologist.
BMP 1-9 Determining Tractor Loggable Ground: To minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems.	Limit ground skidding and machine piling with tractors to slopes less than 35%. Endlining can be used to remove logs from steeper slopes. Ground disturbance on areas of shallow soils, notably soils adjacent and abutting to rock outcrops, will be avoided.
BMP 1-10 Tractor Skidding Design: By designing skidding patterns to best fit the terrain, the volume, velocity, concentration, and direction of runoff water can be controlled in a manner that will minimize erosion and sedimentation.	The sale administrator and purchaser will designate all skid trails prior to ground disturbing activities. If uncertainty arises regarding potential resource impacts of skid trail location, consult with an earth science specialist (i.e., hydrologist, aquatic biologist, or soil scientist).
BMP 1-11 Suspended Log Yarding in Timber harvesting: To protect the soil mantle from excessive disturbance; to maintain the integrity of the SMZ or other sensitive watershed area; to control erosion on cable corridors.	Helicopter yarding has been specified on steep slopes in this project.
BMP 1-12 Log Landing Location: To locate new landings in such a way as to avoid watershed impacts and associated water quality degradation	The following criteria are to be used by the Sale Administrator when evaluating landings: a. The cleared or excavated size of landings will not exceed that needed for safe and efficient skidding and loading operations. Trees considered dangerous will be removed around landings to meet the safety requirements of OSHA. b. Selected landing locations will involve the least amount of excavation and fill possible. Landings must be located outside of SMZs. c. Locate landings near ridges away from headwater swales in areas that will allow skidding without crossing stream channels, violating SMZs, or causing direct deposit of soil and debris to a stream. d. Locate landings where the least number of skid roads will be required, and sidecast can be stabilized without entering drainages or affecting other sensitive areas. Keep the number of skid trails entering a landing to a minimum. e. Position landings such that the skid road approach will be nearly level as feasible, to promote safety and to protect soil from erosion. f. Avoid excessive fills associated with landings constructed on old landslide benches. g. Construct stable landing fills or improve existing landings by using appropriate compaction and drainage specifications. In some cases, using an existing landing located within an RCA or CAR is preferable to constructing a new landing outside of it. These situations will be reviewed on a site-by-site basis by an earth science specialist (aquatics, hydrology, geology, or soils).
BMP 1-13 Erosion Prevention and Control Measures during Timber Sale Operations: To ensure that the purchasers' operations will be conducted reasonably to minimize soil erosion.	Timber purchaser responsibilities for erosion control will be set forth in the Timber Sale Contract. Equipment will not be operated when ground conditions are such that excessive damage will result. The kinds and intensity of control work required of the purchaser will be adjusted by the sale administrator to ground and weather conditions with emphasis on controlling overland runoff, erosion, and sedimentation. Erosion control work required by the contract will be kept current. At certain times of the year this means daily, if precipitation is likely or weekly when precipitation is predicted for the weekend. Erosion prevention measures must be applied no later than October 1

<table>
<tr><th>BMP Name, Objective, and Direction</th><th>Application to the King's River Project</th></tr>
<tr><td></td><td>and immediately upon completion of activity begun after November 1.
If the purchaser fails to perform seasonal erosion control work prior to any seasonal period of precipitation or runoff, the Forest Service may temporarily assume responsibility, complete the work, and use any unencumbered deposits as payment for the work.</td></tr>
<tr><td>BMP 1-16 Log Landing Erosion Protection and Control: To reduce the impacts of erosion and subsequent sedimentation associated with log landings by use of mitigating measures.</td><td>Landings will be properly cross-ditched, ripped (if soils are compacted), re-contoured (as necessary), and mulched after use and before the winter precipitation period, whichever comes first. Excess material not needed for erosion control can be piled and burned. Upon completion of the project, consult with the hydrologist or soil scientist to determine the need for additional soil protection measures.</td></tr>
<tr><td>BMP 1-17 Erosion Control of Skid Trails: To protect water quality by minimizing erosion and sedimentation derived from skid trails.</td><td>Erosion control measures will be installed on all skid trails, tractor roads, and temporary roads. Erosion control measures include, but are not limited to, cross ditches (water bars), organic mulch, and ripping.
Cross ditches will be spaced according to the guidelines below, maintained in a functioning condition, and placed in locations where drainage would naturally occur (i.e., swales). The level of maintenance will be contingent upon existing or predicted weather patterns as determined by the Sale Administer (see BMP 1-13).
Minimum Cross Drain Spacing
<table><tr><th>% Slope</th><th>Maximum Spacing</th></tr><tr><td>0 - 15</td><td>125 feet</td></tr><tr><td>15 - 35</td><td>45 feet</td></tr></table></td></tr>
<tr><td>BMP 1-18 Meadow Protection during Timber Harvesting: To avoid damage to the ground cover, soil, and hydrologic function of meadows.</td><td>Mechanical equipment is not permitted in meadows unless specifically authorized by an aquatic biologist and hydrologist.</td></tr>
<tr><td>BMP 1-19 Streamcourse and Aquatic Protection: The objectives of this BMP are:
a. To conduct management actions within these areas in a manner that maintains or improves riparian and aquatic values.
b. To provide unobstructed passage of stormflows.
c. To control sediment and other pollutants entering streamcourses.
d. To restore the natural course of any stream as soon as practicable, where diversion of the stream has resulted from timber management activities.</td><td>a. The location and method of crossings on Class IV and V streams must be agreed to by the sale administrator (SA) prior to construction.
b. Stream crossings on Class I – III streams must be approved by the hydrologist and aquatic biologist.
c. Damage to stream banks and channels will be repaired to the extent practicable.
d. All sale-generated debris will be removed from streamcourses, unless otherwise agreed to by the SA, and in an agreed upon manner that will cause the least disturbance.
e. Felled trees will not be pulled across perennial or intermittent stream channels without prior approval by the hydrologist or aquatic biologist.
f. Methods for protecting water quality while utilizing tractor skid trail design in stream course areas where harvest is approved include: (1) end lining, (2) falling to the lead, and (3) utilizing specialized equipment with low ground pressure such as feller buncher harvester.
g. Water bars or other erosion control structures will be located so as to disperse concentrated flows and filter out suspended sediments prior to entry into streamcourse.
h. Material from temporary road construction and skid trail streamcourse crossings will be removed and streambanks restored to the extent practicable.
i. Special slash treatment site preparation activities will be prescribed in sensitive areas to facilitate slash disposal without use of mechanized equipment.
j. Project-related bare soil areas (e.g. skid trails, landings, temporary roads, etc.) will be covered with existing native vegetation mulch, organic debris, or certified weed free straw to at least 50%, well distributed cover, and cross-ditched per BMP 1-17 requirements.</td></tr>
<tr><td>BMP 1-20 Erosion Control Structure Maintenance: To ensure that constructed erosion control structures are stabilized and working</td><td>During the period of the timber sale contract, the purchaser will provide maintenance of soil erosion control structures contracted by the purchaser until they become stabilized, but not more than one year after their construction. If the purchaser fails to do seasonal maintenance work, the Forest Service may assume the responsibility and charge the purchaser accordingly. The Forest Service sale administrator is responsible for ensuring erosion control maintenance work is completed.</td></tr>
<tr><td>BMP 1-21 Acceptance of Timber Sale Erosion Control Measures before Sale</td><td>The sale administrator must inspect erosion control measures to ensure their adequacy prior to accepting closure on the unit and/or sale.
The effectiveness of erosion control measures will be evaluated using BMPEP protocols</td></tr>
</table>

BMP Name, Objective, and Direction	Application to the King's River Project
Closure: To ensure the adequacy of required erosion control work on timber sales.	(see Monitoring Plan) after the sale area has been through one or more wet seasons. This evaluation is to ensure that erosion control treatments are in good repair and functioning as designed before releasing the purchaser from contract responsibility. The purchaser is responsible for repairing erosion control treatments that fail to meet criteria in the Timber Sale Contract, as determined by the Sale Administer, for up to one year past closure of the sale.
BMP 1-22 Slash Treatment in Sensitive Areas: To maintain or improve water quality by protecting sensitive areas from degradation which would likely result from using mechanized equipment for slash disposal.	All burn piles made with mechanical equipment must be located outside of the SMZ. Hand piles will be kept at least 20 feet away from all streams, meadows, springs, seeps, and other sensitive aquatic areas. In Alternative 3, special mechanized fuels treatment has been specified in sub-watersheds with cumulative watershed effects concerns in order to minimize ground disturbance.
BMP 2-1 General guidelines for the Location and Design of Roads: To locate and design roads with minimal resource damage.	The following considerations are incorporated into the planning process of road location and design. These measures are preventative, apply to all transportation activities, and indirectly protect water quality: (a) Transportation facilities will be developed and operated to best meet the resource management objectives with the least adverse effect on environmental values. (b) The location, design, and construction of roads will include the use of the IDT. (c) Sensitive areas such as wetlands, inner gorges, and unstable ground will be avoided to the extent practiable. (d) Stream crossings will be designed to provide the most cost efficient drainage facility consistent with resource protection, facility needs, and legal obligations.
BMP 2-3 Timing of Construction Activities: To minimize erosion by conducting operations during minimal runoff periods and when soils are dry and less prone to compaction.	Ground-disturbing activities will occur when soils are dry. In some cases soils may never dry sufficiently. Ground-disturbing work that occurs off of existing roads will occur during the dry season and will reduce ground disturbance as much as possible.
BMP 2-5 Road Slope Stabilization Construction Practices: To reduce sedimentation by minimizing erosion from road slopes and slope failure along roads.	An adequate soils and geologic investigation will be conducted when finalizing new road construction designs for: correct cut and fill steepness based on the angle of repose for the type of material; methods to handle surface runoff; and necessary compaction standards and surfacing needs.
BMP 2-7 Control of Road Drainage: To minimize the erosive effects of water concentrated on roads, to disperse runoff from road surfaces, to lessen sediment yield from roaded areas, and to minimize erosion of the road prism.	Newly constructed or reconstructed roads will be designed to reduce hydrologic connectivity and soil erosion wherever feasible. The sale administrator or other Forest Service representative will ensure that roads are adequately maintained during project implementation to ensure that road drainage features function as designed.
BMP 2-8 Constraints Related to Pioneer Road Construction: To minimize sediment production and mass wasting from pioneer road construction.	(a) Roads will be constructed within the planned roadway limits unless otherwise specified or approved by the ER or COR. (b) Pioneer roads will be located to prevent undercutting of the designated final cut slope, avoid deposition of materials outside the designated roadway limits, and accommodate drainage with temporary culverts or log crossings. (c) Erosion control work will be completed prior to the rainy season and in accordance with the contract. (d) Crossing sites on live streams will be dewatered during construction with diversion devices (see BMP 2-15).
BMP 2-9 Timely Erosion Control Measures on Incomplete Roads and Stream Crossing Projects: To minimize erosion and sedimentation from disturbed ground on incomplete projects.	Erosion control must be completed before the rainy season (usually October in the KRP project area). Preventative measures for timely erosion control include: (a) Removal of temporary culverts, culvert plugs, diversion dams, or elevated stream crossings. (b) Installation of temporary culverts, side drains, flumes, cross drains, diversion ditches, energy dissipaters, dips, sediment basins, berms, debris racks, or other facilities needed to control erosion. (c) Removal of debris, obstructions, and spoil material from channels and floodplains. (d) Planting vegetation, mulching, and/or covering exposed surfaces with jute mates or other protective material.
BMP 2-10 Construction of Stable Embankments: To construct embankments	Roadways will be designed and constructed as stable and durable earthwork structures with adequate strength to support the treadway, shoulders, subgrade and road traffic

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with materials and methods which minimize the possibility of failure and subsequent water quality degradation.	loads.
BMP 2-11 Control of Sidecast Material During Construction and Maintenance: To minimize sediment production originating from sidecast material during road construction or maintenance.	Sidecasting is not permitted within SMZs. Waste areas must be located where excess material can be deposited and stabilized.
BMP 2-12 Servicing and refueling equipment: To prevent pollutants such as fuels, lubricants, bitumens and other harmful materials from being discharged into or near rivers, streams and impoundments, or into natural or man-made channels.	Storage of hazardous materials (including fuels) and servicing and refueling of equipment will be conducted at pre-designated locations outside of RCAs and CARs. If fueling and/or storage of hazardous materials are needed within RCAs or CARs, those sites must be reviewed and approved by the District Hydrologist or Aquatic Biologist. Additional protection measures, such as containment devices, may be necessary.
BMP 2-13 Control of Construction and Maintenance Activities Adjacent to SMZs: To protect water quality by controlling construction and maintenance actions within and adjacent to SMZs so that SMZ functions are not impaired.	Construction and maintenance fills, sidecast, and end-hauled materials will be kept out of SMZs except at designated crossing sites to minimize the effect to the aquatic environment.
BMP 2-14 Controlling In-Channel Excavation: To minimize stream channel disturbances and related sediment production.	There will be no in-channel or streambank excavation during any phase of project activities unless authorized by the district hydrologist or aquatic biologist.
BMP 2-16 Stream Crossings on Temporary Roads and Skid Trails:	Mechanical equipment crossing of perennial and intermittent (generally class I – III) streams is not permitted unless approved by the district hydrologist or aquatic biologist. Ephemeral streams (stream class IV and V) may be crossed at designated locations as agreed upon by the sale administrator and purchaser. Designate skid trails to avoid stream crossings and SMZs wherever possible. Designated crossings must be as perpendicular to the channel as possible and avoid sensitive soils and riparian vegetation damage. Stream banks must be repaired upon completion of the project.
BMP 2-19 Disposal of Right-of-Way and Roadside Debris: To ensure that organic debris generated during road construction is kept out of streams so that channels and downstream facilities are not obstructed.	If slash generated by road work is disposed of within SMZs, it will be piled and burned or chipped. Material may also be removed from the SMZ for disposal.
BMP 2-21 Water Source Development Consistent with Water Quality Protection: To supply water for roads and fire protection while maintaining existing water quality.	Water drafting will not occur in streams when the base discharge is less than 1.5 cfs, and will not draft more than 50% of the ambient discharge over 1.5 cfs. New drafting sites shall be approved by the District Hydrologist or Fisheries/Aquatic Biologist and located to minimize sediment and maintain riparian resources, channel condition, meadow integrity, and aquatic species viability and habitat. Approaches will be as near perpendicular to the stream as possible and will be gravel surfaced or otherwise stabilized. If water-drafting is required, pumps with low entry velocity and suction strainers with screens less than 2 mm in size (1/8 in.) will be used.
BMP 2-22 Maintenance of Roads: To maintain roads in a manner that provides for water quality protection by minimizing rutting, failures, sidecasting, and blockage of drainage facilities, all of which can cause erosion, sedimentation, and deteriorating watershed conditions.	Roads needed for project activities will be brought to current engineering standards of alignment, drainage, and grade before use, and will be maintained through the life of the project. Roads will be inspected at least annually to determine what work, if any, is needed to keep ditches, culverts, and other drainage facilities functional and the road stable.
BMP 2-23 Road Surface Treatment to Prevent Loss of Materials:	Surface stabilization will be considered where grades exceed 12% or road is within riparian conservation areas.
BMP 2-24 Traffic Control During Wet Periods: To reduce road surface disturbance and the rutting of roads, and to minimize sediment washing from disturbed road surfaces.	On roads not designated for all weather or winter haul, heavy equipment operations will be limited until the period after the soil has dried in the top 12 inches in the spring.
BMP 2-26 Obliteration or	Temporary roads will be obliterated after serving their intended purpose for this project.

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Decommissioning of Roads: To reduce sediment generated from temporary roads, unneeded system and non-system roads by obliterating or decommissioning them at the completion of the intended use.	This includes: (1) road effectively barricaded; (2) road effectively drained by measures such as re-contouring or outsloping to return surface to near natural hydrologic function; (3) a well distributed mulch or organic cover provides at least 50% cover, or road surface is revegetated using local native species; (4) sideslopes are reshaped and stabilized to match the natural contour (as necessary); and (5) stream crossings are removed and natural channel geometry is restored. If non-local mulch is used (such as straw), it must be approved by the Forest Service as weed free.
BMP 5-8 Pesticide Application According to Label Directions and Applicable Legal Requirements: To avoid water contamination by complying with all label instructions and restrictions for use.	This BMP requires glyphosate applicators to strictly adhere to pesticide label instructions.
BMP 5-11 Cleaning and Disposal of Pesticide Containers and Equipment: To prevent water contamination resulting from cleaning or disposal of pesticide containers.	The cleaning and disposal of glyphosate containers will be done in accordance with Federal, State, and local laws, regulations and directives.
BMP 5-12 Streamside Wet Area Protection During Pesticide Spraying: To minimize the risk of pesticide inadvertently entering waters, or unintentionally altering the riparian area, SMZ, or wetland.	When spraying glyphosate, an untreated strip of land and vegetation will be left alongside surface waters, wetlands, riparian areas, or SMZ. Strip widths established by the IDT are 5 feet for dry channels and 25 feet for flowing channels (see Herbicide Use design criteria).
BMP 6-2 Consideration of Water Quality in Formulating Fire Prescriptions: To provide for water quality protection while achieving the management objectives through the use of prescribed fire.	Prescribed burning is planned at the minimum intensity and severity necessary to achieve management objectives, and each Burn Plan will incorporate all relevant design measures from this EIS.
BMP 6-3 Protection of Water Quality from Prescribed fire Effects: To maintain soil productivity, minimize erosion, and minimize ash, sediment, nutrients, and debris from entering water bodies.	Fires will be allowed to back into riparian vegetation, but direct lighting within riparian vegetation will not occur. All fire lines within RCAs and CARs will be water barred per BMP 1-17 spacing requirements. Fire lines within RCA (i.e., 150 ft., seasonal streams, and 300 ft. perennial streams, springs, and meadows) will be designed and constructed to reduce sediment entry into channels. Fire lines in RCAs will cross perpendicular to streams and follow the natural landscape contour as much as possible. Firelines within the SMZ will be hand cut. Waterbars will be placed on either side of each stream crossing to prevent or reduce sediment entry into streams.
BMP 7-3 Protection of Wetlands: To avoid adverse water quality impacts associated with destruction, disturbance, or modification of wetlands.	Ground disturbing activities will not occur in wetlands or meadows.
BMP 7-4 Oil and Hazardous Substance Spill Contingency Plan and Spill Prevention Containment and Countermeasure (SPCC) Plan: To prevent contamination of water from accidental spills.	A spill contingency plan and spill prevention and countermeasure plan (SPCC) must be prepared if hazardous materials (including fuels and oils) stored on the Sierra National Forest exceed 1320 gallons, or if a single container exceeds 660 gallons. The plan will at a minimum include: the types and amounts of hazardous materials located in the project area, pre-project identified locations for hazardous materials storage and fueling/maintenance activities (must be located outside of RCA and CAR unless prior approval by District Hydrologist or Aquatic Biologist is obtained), methods for containment of hazardous materials and contents of on-site emergency spill kit, and a contingency plan (including contact names with phone numbers) to implement in the event of a spill. The SPCC plan must be approved by the Forest Service prior to project implementation.

2. Within riparian conservation areas (RCA) and critical aquatic refuges (CAR), reduce as much as possible ground disturbing impacts (i.e., soil compaction, vegetation disturbance, etc.). Utilize helicopters or other non-ground disturbing actions to operate off existing roads as necessary to achieve riparian conservation objectives. If vegetation and soil disturbance does not recover within one year,

consult with Forest Service specialists (botanist, soil scientist, and/or hydrologist) to determine follow-up treatments.

3. For prescribed fire units, avoid direct lighting within riparian vegetation and or within the SMZ; prescribed fires may back into SMZ and riparian vegetation areas. For the prescribed fire units in the KREW study, avoid direct lighting within 5 feet of the stream channel or within riparian vegetation.
4. Locate hazardous material (including oils and fuels) storage and refueling sites outside of RCA and CAR, except at administrative sites and sites covered under a special use authorization, unless approved by an aquatic or watershed specialist.
5. Do not remove or otherwise alter existing riparian vegetation.
6. Do not build new roads, including temporary roads, within the SMZ unless approved by an aquatic or watershed specialist.
7. Obliterate temporary roads within the SMZ wherever feasible.
8. In sub-watersheds over the lower TOC, conduct logging operations on tractor ground (slopes < 35%) using light-on-the-land logging systems such as Cut-to-Length or Whole Tree Yarding systems when feasible.

Watershed measures specific to Alternative 3

9. In addition to the objectives and requirements of BMP 1-8 and 1-19, Streamside Management Zones (SMZ) are managed primarily to protect and maintain water quality, site productivity, channel stability, wildlife habitat, and riparian vegetation (see FSM, Sierra NF SUPP. No. 8). Additional benefits were recognized under the Sierra Nevada Forest Plan Amendment (USDA 2004a) Aquatic Management Strategy, with specific Conservation Objectives relating to protecting the beneficial uses of water; the geomorphic and biological characteristics of aquatic systems; a sufficient and renewable source of large woody debris; providing suitable habitat for aquatic and riparian species; maintaining or enhancing special aquatic features as habitat for species dependent on unique habitats; and the identification and implementation of restoration actions to enhance habitat for riparian/aquatic species. The objectives can be summarized as:
    a. Watershed objectives based on the five critical elements to consider in the management of streamside management zones, including (FEMAT 1993):
        i. Large Woody Debris
        ii. Ground Cover (litter fall: nutrient recycling)
        iii. Root strength (bank stability)
        iv. Shading (canopy cover)
        v. Microclimate (soil moisture; radiation; soil temperature; air temperature; wind speed; and relative humidity)
    b. Fuel reduction objectives
    c. Terrestrial wildlife habitat objectives

i. Cover (hiding)

ii. Nesting and denning habitat

d. Management Prescription for Class I and Class II SMZs[5]

i. Do not treat vegetation within the SMZs of Class I or II streams in sub-watersheds over the lower threshold of concern (TOC).

ii. In the outer 50 feet of other SMZs, thin trees to reduce fuel loading by:

1. Removing ladder fuels (intermediate and suppressed trees)
2. Removing diseased trees that will fall away from riparian areas, and
3. Hand-piling slash as necessary to reduce the effects of under burning
4. maintaining trees with broken tops for source of large woody debris (LWD) recruitment

e. For Class I and Class II SMZ not within sub-watersheds exceeding the lower TOC and not within Old Forest Linkage: Retain a minimum of 280 square feet of basal area featuring mature and decadent stand characteristics within rest sites identified by the scorecard using favored features preferred by fisher.

f. For Class I and Class II SMZ not within sub-watersheds exceeding the lower TOC and not within the Old Forest Linkage: Avoid the creation of openings by limiting thinning to 30% of the existing basal area.

i. Establish monitoring points within treatment areas to evaluate the effectiveness of the SMZ as a sediment buffer.

ii. Do not allow mechanical equipment within streamside management zones (SMZ).

10. Do not harvest trees in the inner 50 feet of RMA on perennial streams in areas proposed for helicopter logging.
11. Require road reconstruction at selected locations in order to reduce the length of road that is hydrologically connected to the stream network, as described in the Watershed section of Chapter 3. This applies to roads used during project implementation where current design allows long distances of road surface drainage to directly enter stream channels. This hydrologic connection may be mitigated by using combinations of several techniques, including:

- Outsloping of road surfaces to quickly direct runoff from the road surface rather than concentrating flows in an inboard ditch and routing it to the stream channel;

[5] Refer to the project file for the locations of specific SMZ buffer widths

- Installing rolling dips and /or additional relief culverts to minimize the length of road drainage entering stream channels, with outlet treatments to minimize the risk of fillslope erosion; and
- Rocking of ditches to reduce flow velocity in the ditch, prevent ditch erosion, and encourage deposition, where other techniques are not feasible.

This design measure will prioritize opportunities within the 8 sub-watersheds where cumulative watershed effects are a concern (sub-watersheds 519.0009 and 519.3053 in the n_soapro_2 management unit, 519.4051 in providen_1, 520.0014 in el_o_win_1, glen_mdw_1, and krew_prv_1, and 520.1002, 520.1051, 520.1101, and 520.1151 in bear_fen_6). These design measures will be considered in other watersheds, as practicable. Engineering will identify opportunities and implement this design measure in coordination with a Forest watershed specialist where hydrologic connectivity of road-channel crossings is a potential concern. Site-specific mitigations will be designed when the road reconstruction package is developed for each management unit.

12. Substitute grapple piling in areas proposed for tractor piling in sub-watersheds that are over the lower TOC.

Wildlife Species: The design measures were adopted from the SNFPA 2004 ROD Appendix A: Management Direction except as follows:

Early in the development of the proposed action and project design measures, it became evident that limited operating periods in the design measures for California spotted owl, northern goshawk and the great grey owl were incompatible with the KREW Studies in Management Units krew_bul_1 and krew_prv_1. The KREW Studies require the activities intended to address several questions posed in the SNFPA 2004 Record of Decision to take place in as few years as possible to concentrate the effects in time and provide the greatest opportunity for accomplishing the objectives of the Studies. These limited operating periods are incompatible with the requirements of the KREW Studies so would not be applied in krew_bul_1 and krew_prv_1 Management Units.

Similarly, it became evident early that the limited operating periods and limitations on activities in the WUI threat zone in the design measures for California spotted owl were incompatible with the CSOS. It is designed to treat some protected activity centers (PAC) using the management direction for the defense zone of the WUI from the SNFPA Record of Decision of 2001 in whatever land allocation the PAC are located. The design measures for the WUI threat zone would be more limiting and the limited operating periods would not allow for concentrating the effects in time so they would not be applied within the CSOS.

The long-term goal for developing and/or maintaining potential fisher habitat is to have 50% of the landscape in CWHR size class 4 or higher with 50% canopy cover or greater and is based on several factors:

- Historically, the capability of the land to grow and maintain canopy cover varies by potential natural vegetation type and aspect. The ponderosa pine type is not capable of canopy covers greater than 60%. The mixed conifer type is more likely to have canopy cover greater than 60% on north and east aspect because

they are cooler and wetter than south and west aspects. The true fir type usually has canopy cover greater than 60% on all aspects.

- Agee (1996) and Van Wagtentock (1996) have both described forty percent canopy cover as a threshold for sustaining crown fires. Canopy cover alone is not a predictor of crown fire (Van Wagner, 1977). Ground fuels, ladder fuels, species, topography and overstory canopy cover are all factors in the initiation and movement of crown fires (Scott and Reinhardt 2001, Agee and Skinner 2005). The need to reduce the risk of wildfire requires a lower goal for canopy cover for fisher habitat in the WUI.

1) Outside the CSOS: Surveys are to establish or confirm the location of the nest or activity center where activities are planned within or adjacent to a protected activity center (PAC) (USDA 2004).

   a) Mechanical treatments are to meet fuels objectives in protected activity centers (PAC) located in WUI defense zones. In PAC located in WUI threat zones, mechanical treatments occur where prescribed fire is not feasible and where avoiding PAC would significantly compromise the overall effectiveness of the landscape fire and fuels strategy. Design mechanical treatments to maintain habitat structure and function of the PAC.

   b) Mechanical treatments occur in protected activity centers; (PAC) located in WUI defense zones and, in some cases, threat zones, yet prohibited within a 500-foot radius buffer around a spotted owl activity center within the designated PAC. Prescribed fire occurs within the 500-foot radius buffer. Hand treatments, including hand line construction, tree pruning, and cutting of small trees (less than 6 inches dbh), may be conducted prior to burning as needed to protect important elements of owl habitat. Treatments in the remainder of the PAC use the forest wide standards and guidelines for mechanical thinning.

   c) Except in Management Units krew_bul_1 and krew_prv_1 and PAC involved in the CSOS Study, maintain a limited operating period (LOP), prohibiting vegetation treatments within approximately ¼ mile of the activity center during the breeding season (March 1 through August 31), unless surveys confirm that California spotted owls are not nesting. Prior to implementing activities within or adjacent to a California spotted owl PAC and the location of the nest site or activity center is uncertain, conduct surveys to establish or confirm the location of the nest or activity center (USDA 2004a).

   d) In PACs located outside the defense zone of the urban wild land inter-mix zone: Limit stand-altering activities to reducing surface and ladder fuels through prescribed fire treatments. In forested stand with overstory trees 11 inches dbh and greater, design prescribed fire treatments that have an average flame length of 4 feet or less. Prior to burning, conduct hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches dbh), within a 1- to 2-acre area surrounding known nest trees as needed to protect nest trees and trees in their immediate vicinity.

2) Northern goshawk and PAC: Under the Sierra Nevada Forest Land Management Plan Amendment protected activity centers (PAC) would be established for known

and discovered northern goshawks (200 acres) to protect breeding adults and their offspring. Designate northern goshawk PAC based upon the latest documented nest site and locations(s) of alternate nests. If the actual nest site is not located, designate the PAC based on the location of territorial adult birds or recently fledged juvenile goshawks during the fledgling dependency period.

a) Except in Management Units krew_bul_1 and krew_prv_1 and PAC involved in the CSOS Study, maintain a limited operating period (LOP), prohibiting vegetation treatments within approximately ¼ mile of the nest site during the breeding season (February 15 through September 15) unless surveys confirm that northern goshawks are not nesting. If the nest stand within a protected activity center (PAC) is unknown, either apply the LOP to a ¼ mile area surrounding the PAC, or survey to determine the nest stand location (USDA 2004a, p.60).

b) Conduct surveys when activities are planned within or adjacent to a PAC to establish or confirm the location of the nest or activity center.

3) Great Gray Owl: Currently we are conducting surveys for the great gray owl. Except in Management Units krew_bul_1, krew_prv_1, and PACs involved in the CSOS Study, the following may be needed: apply a limited operating period, prohibiting vegetation treatments and road construction within ¼ mile of an active great gray owl nest stand, during the nesting period (typically March 1 to August 15). The LOP may be waived for vegetation treatments of limited scope and duration, when a biological evaluation determines that such projects are unlikely to result in breeding disturbance considering their intensity, duration, timing and specific location. Where a biological evaluation concludes that a nest site would be shielded from planned activities by topographic features that would minimize disturbance, the LOP buffer distance may be reduced.

4) Southern Sierra Fisher Conservation Area: The following design measures are included;

a) Protect important habitat structures such as large diameter snags and oaks, patches of dense large trees typically ¼ to 2 acres, large trees with cavities for nesting, and coarse woody material. Use firing patterns, place fire lines around snags or large logs, and implement other prescribed fire techniques to minimize the effects;

b) Refer to Table 2-16 for additional measures;

c) If a den site or reproductive female is found in Krew_bul_1 or Krew_prov_1 units a limited operating period will be required from March 1 through June 30. There are no other limited operating requirements in these two units for Alternative 1 for all species.

5) Furbearers: The conservation strategies for the Sierra Nevada red fox, marten and wolverine conservation contain three critical elements:

a.)Recover and protect populations

b.) Minimize fragmentation

c.) Protect den sites

6) A specified area would be delineated to protect all known nesting, roosting, and denning sites as follows:

a.) Marten den sites: 100 acres of the highest quality habitat surrounding den sites, arranged in as compact a unit as possible.

b.) Upon a detection (photograph, track plate, or sighting verified by a wildlife biologist) of a wolverine or Sierra Nevada red fox, conduct an analysis to determine if activities within 5 miles of the detection have a potential to affect the species. For a 2-year period following the detection, restrict activities that are determined in the analysis to have an adverse impact from January 1 to June 30.

Table 2-16 - Protection Measures for Fisher and Habitat

Balancing community protection treatments with long-term management of high-quality fisher habitat	Develop fuels treatment and restoration strategies for the KRP Management Units that provide for the protection of communities in concert with meeting the long-term goal of developing and/or maintaining 50% of the overall potential fisher habitat in CWHR size class 4 or higher with 50% canopy cover or greater. This guideline is intended to ensure that fuels treatments and ecological restoration strategies also address short-term protection and long-term sustainability of fisher habitat.
Maintain high canopy cover in fisher habitat.	The size of the KRP Management Units averages 900 acres which is approximately 1/3 the size of a female fisher home range (based on fisher research within the KRP area). As female fisher home ranges are smaller than male home ranges, no more than 1/3 of any fisher home range is treated at one time. Treatments are spread out in space and time to further reduce impacts on a individual fisher. Treatments are scheduled so that no adjacent Management Units will be treated within a 5-year period. There is one exception to the treatment schedule for KRP Management Unit "KREW Providence 1" located in the vicinity of Providence Creek, associated with the KREW research project, and within the wildland urban intermix
Adapt management of fisher habitat based on monitoring and new information	Whatever combination of techniques is employed, our intention is to examine fisher habitat in the Big Creek and Dinkey Creek drainages that include the initial eight KRP Management Units as well as untreated control sites. We will be monitoring fisher activities before, throughout the three major phases of treatments (logging, mastication, prescribed fire), and after treatments to determine fisher use of treated and untreated habitats.

Wildlife measures specific to Alternative 3

Alternative 3 includes the fisher protection measures identified by the FWS. Alternative 3 is also designed to implement the long range desired condition for known or estimated female fisher home range, which is to have a minimum of 50 percent of the forested areas with at least 60 percent canopy cover.

Protection measures identified by the USFWS for fisher are adopted, including:

- Increasing retention of stands with >60% canopy cover following treatment
- Protecting important habitat structures such as large diameter snags and oaks, patches of dense large trees (typically ¼ to 2 acres), large trees with cavities for nesting, and coarse woody material. Use firing patterns and place fire lines around snags and large logs to minimize effects of underburning. Use the "Fisher and Priority Sites Marking Guide – Kings River Project" to identify the most suitable individual trees and groups of trees for retention.
- Maintain large trees suitable for denning and resting by restricting harvest to trees less than 30" dbh. Retain oaks unless they are a hazard to operations.

- Modifying burning schedules to avoid the fisher denning season (mid March to mid May) to the extent possible.
- Create a system of Old Forest Linkages (OFL) along perennial streams, including 300' of adjacent habitat with 50-60% canopy cover on each side of the stream.
- Monitor high quality fisher habitat in two or more of the eight KRP management units and untreated controls

Alternative 2

No Action

Under the No Action alternative, current management plans would continue to guide management of the project area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including: underburning, plantation maintenance, cattle grazing, recreation, and recreation residences.

No uneven-aged management, small group selection, reforestation, watershed restoration, DFPZ construction, vegetation management in the WUI except for maintenance of existing plantations or research associated with the proposed action would occur within the initial eight management units across approximately 13,700 acres as described in the proposed action. No project activities would be implemented to accomplish project goals (historical forest restoration, substantial reduction of the potential for stand replacing wildfire or insect attack, etc).

As described in the Introduction to Chapter 2, each Alternative incorporates the concept of wildfire entering one or a couple of the initial eight management units ten years after the record of decision for the purpose of modeling and analysis of effects. The ten year period was chosen not as a prediction but because it would test the effectiveness of the proposed action after all treatments have been accomplished vs. the no action alternative and display a comparison to the decision maker of the indirect and cumulative effects. Fire records for the KRP indicate it is likely one or a couple of the management units could be significantly affected by a stand replacing fire on a hot windy summer day but it is unlikely numerous management units or an entire watershed would be affected at one time.

Alternative 3

Reduction of Harvest Tree Size

Alternative 3 considers in detail an alternative that was eliminated from detailed study in the Draft EIS. Alternative 3 includes the following actions:

- Treatments associated with the Kings River Experimental Watershed Study.
- Treatments associated with the CSOS.
- Fuel reductions in the Wildland Urban Interface.

- Implementation of the proposed uneven aged management strategy modified to reduce vegetation treatment to trees 30" dbh and smaller.
- Treatment of under stocked areas associated with existing openings by site prep, planting, and release.

The following tables: 2-2, acres of commercial harvest, 2-3 harvest system acres, 2-7 plantation maintenance, 2-8 fuel treatments and fireline, 2-9 fuel burn summary, DFPZ and WUI acres, 2-10 road summary, 2-11 acres of CSO PAC, HCRA, and adjacent stand areas, 2-12 acres of KREW in the initial eight management units, 2-13 watershed restoration projects apply to Alternative 3.

The tables below reflect changes in treatment acres that differ from Alternative 1.

Table 2-17 – Harvest Prescriptions, Alternative 3

MANAGEMENT UNIT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
California Spotted Owl Study, Thin less than 6"	109	18	236	0	23	57	176	0	619
California Spotted Owl Study, Thin less than 20"	677	252	0	0	226	92	61	0	1308
California Spotted Owl Study, Thin less than 10"	119	0	2	0	45	0	0	0	165
No Harvest	277	217	477	458	812	1770	927	662	5601
Uneven-aged Management Strategy - plantation	88	27	0	14	13	23	14	0	179
Uneven-aged Management Strategy Upper Diameter Limit 30"	935	842	903	723	872	477	836	387	5975
Grand Total	2205	1357	1618	1195	1991	2419	2014	1049	13847

Table 2-18 - Herbicide Use (Glyphosate & Surfactant) Alternative 3

Management Unit	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
Treat Existing Openings Chemical Release 1 Application	26	29	12	42	18	0	0	0	127
Treat Existing Openings Chemical Release 2 Application	71	32	38	0	25	32	78	27	303
Treat Existing Openings Chemical Release 2+ Application	0	0	0	0	0	13	29	17	58
Noxious Weed chemical Spray	9	1	4	0	1	1	2	12	29
Noxious Weed Chemical Spray and Hand Pull	5	1	0	0	0	0	0	1	6
Noxious Weed Chemical Spray and Weed Wrench	1	0	0	0	0	0	0	0	1
Plantation Chemical Release 2 Application	6	0	0	112	65	25	0	0	208
Plantation Chemical Release 1 Application	0	0	0	0	0	43	124	0	166
Plantation Chemical Site Preparation for Planting	0	0	0	0	33	43	124	0	199
Management Unit subtotal Chemical treatment	117	63	54	154	140	156	355	57	1097
Total Management Unit Acres	2205	1357	1618	1195	1991	2419	2014	1049	13847

Table 2- 19 - Reforestation and Hand Release Summary, Alternative 3

MANAGEMENT UNIT	bear_fen_6	el_o_win_1	glen_mdw_1	krew_bul_1	krew_prv_1	n_soapro_2	providen_1	providen_4	Grand Total
Noxious Weed hand Pull Only	0	0	1	0	1	1	1	0	3
Treat Existing Openings Site Preparation, Tractor Pile	50	54	50	50	41	51	79	0	375
Treat Existing Openings Site Preparation, Mastication	4	18	9	0	8	12	34	14	100
Treat Existing Openings Site Preparation, Hand Pile	43	1	0	9	2	0	27	30	111
Treat Existing Openings Hand Release 1 Application	46	10	8	0	2	0	10	0	76
Treat Existing Openings Hand Release 2 Application	26	55	9	50	18	0	16	0	174
Treat Existing Openings Burn Piles	69	60	50	50	42	51	97	0	420
Treat Existing Openings Plant	93	65	50	50	42	51	99	44	494
Treat Existing Openings Replant	12	36	0	42	20	24	17	8	160
Treat Existing Openings Thin and Remove Damaged Small Trees	97	42	43	50	33	13	63	30	371

All treatments outside of the research areas will be consistent with the standards and guidelines in the 2004 Sierra Nevada Forest Plan amendment, including the following key provisions.

- Within known or estimated female fisher home ranges outside WUI, 50% of the forested area has at least 60% canopy closure.
- No group selection prescriptions will be implemented; however site preparation and planting trees within existing openings would occur in existing openings.

The specific design measures altered for Alternative 3 are aquatics, watershed and wildlife. Refer to Design Measures listed under Alternative 1 for the specifics.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of restoring the historical pre-1850 forest conditions across a large landscape using the KRP uneven-aged silvicultural strategy and prescribed fire, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below (additional alternative combinations are documented in "A Strategy for Historical Forest Restoration Using Uneven-aged Silviculture and Prescribed Fire at the Landscape Scale" (Appendix C)).

The alternatives considered but eliminated from detailed study include the following: Eliminate Herbicide Use; Study Previously Harvested Areas.

ELIMINATE HERBICIDE USE

Implement the proposed action with the following exception: eliminate the use of herbicide. This alternative addresses Issue #2; the use of herbicides/surfactant will create an adverse risk of harmful effects to people and wildlife.

We received comments expressing concern over the use of herbicides. A response from Californians for Alternatives to Toxics applauded our effort to reduce hazardous fuel levels and our effort to restore the historical forest conditions but expressed concern with the use of herbicides.

This alternative was considered but eliminated from further study, as it does not meet the need of this project to control weeds. It is essential to control noxious weeds throughout the project area and competing vegetation in reforestation groups and plantations. Based on the site specific analysis described in this EIS, the noxious weeds and intensive vegetative competition found in the project area would preclude meeting stocking levels and the desired species composition.

Where reforestation groups are located in the uneven-aged silviculture stands there is a need to control competing vegetation including: bear clover (*Chamaebatia foliolosa*);

manzanita (*Arctostaphylos spp*.); and deerbrush (*Ceanothus spp*). These brush species sprout and are very competitive with conifer seedlings for soil moisture and nutrients because they have deep roots systems and grow in dense stands which prevent other vegetation from being established. Competing vegetation needs to be reduced to less than 20% crown closure around conifer seedlings for a period of 2-3 years following planting (McDonald and Oliver 1984). This effect of decreasing survival and growth with increasing brush cover has been noted by other studies (Powers and others 2004, Wagner and others 1989, Oliver 1984, Fiddler and McDonald 1984, Fiske 1984). Without vegetation control there is a high probability of reforestation failure or severely reduced growth. In one study, ponderosa pine growing in the middle of deer brush and manzanita had a diameter and height growth of 60 to 90 percent when compared to trees free to grow from competing brush species (Oliver 1979, McDonald and Oliver 1984). Also, the influence of competing vegetation was strongest at wider tree spacing. In another study, without release from deer brush, conifers are at a disadvantage in capturing adequate resources and establishing dominance. McDonald and Fiddler (1989) noted without controlling vegetation growth that the average height of deer brush was 184 percent greater than that of conifer seedlings. The single strongest factor affecting planted tree growth in the detailed long-term soil productivity experiment was understory brush cover (Powers and others 2004). In the Sierra Nevada, where summer drought is common, planted tree productivity averaged more than three times higher in the absence of understory vegetation (Powers and others 2004).

To meet management objectives of conifer survival, multiple herbicide treatments are essential where bear clover and other sprouting shrubs exist. Non-herbicide methods of control (hand, fire, animal and mechanical treatments) are ineffective and not feasible (McDonald and Fiddler 1996, McDonald and Fiddler 1997a). Non-herbicide methods for areas of non-sprouting shrubs and grasses are effective. However, manual and mechanical methods simply do not do not control bear clover and other well established sprouting shrubs. Herbicide application has proven the only effective means to control bear clover on the Sierra National Forest. These results agree with reforestation research that indicates that after three years, only 13 percent of the conifers planted were alive in a study area with bear clover cover of less than 40 percent (Tappenier and Radosevich 1982). This contrasts with 71 percent survival in areas with temporary control of bear clover. Over a 19-year span, only nine percent of the trees planted in an area with no vegetation control survived. Growth of the surviving seedlings is also impacted. In the same study, three-year-old seedlings with no bear clover competition were twice as tall as the seedlings with no vegetation control. A review of bear clover control measures by McDonald and others 2004 also indicate that treatments that kill bear clover rhizomes such as herbicides are the only effective control measure, while other treatments have been failures. Sometimes multiple herbicide treatments are necessary for reforestation as even this method is not totally successful in controlling species like bear clover.

These conclusions are supported by experience over the last two decades on the Sierra National Forest. Previous environmental documents have analyzed reforestation and noxious weed control with similar sites, cover types and vegetative competition as the Kings River Project (e.g. 10S18 Fuel Reduction Project and various reforestation environmental assessments (EA) on both Ranger Districts). These previous analyses examined non-herbicide alternatives or actions and concluded that the exclusive use of manual or mechanical treatments does not meet the objectives of reforesting land that is

suitable and capable of growing conifers and black oak due to the vegetative response of sprouting brush or controlling extensive infestations of noxious weeds (i.e. yellow starthistle). Manual or mechanical treatments alone have not been effective in controlling bear clover, greenleaf manzanita, deerbrush or yellow starthistle on the Forest.

The alternative was eliminated because prior environmental documents, research, and experience indicate that weed control treatments that do not use herbicides do not control sprouting species, and would not meet the purpose and need.

STUDY PREVIOUSLY HARVESTED AREAS

Implement the proposed action with the following exception: Study other previously harvested areas without harvesting more timber.

We received comments from the public asking that we not harvest any trees. Richard Kangas of the Tehipite Chapter of the Sierra Club stated "stands in the KRP area should not undergo commercial harvest in the name of science", and that the "KREW study questions can all be studied at any number of existing sites elsewhere on the forest".

The underlying need for this project is to restore forest conditions. Additional study without treatments does not accomplish that underlying need. This alternative was considered but eliminated from further study for the following reasons:

- This alternative would not assist the agency with the effort to restore the historical pre-1850 forest conditions, nor does not meet the purpose and need to gain knowledge about uneven-aged silvicultural strategy.
- By implementing no harvest, there is no managed attempt to increase the amount of large trees.
- There is no reduction in tree density
- There is no protection afforded to adjacent landowners
- There is no reduced fuel loading or prescribed fire

SIERRA NEVADA FOREST PLAN AMENDMENT (2001)

The Sierra Nevada Forest Plan Amendment (2001) was considered as an alternative. The application of the 2001 standards and guidelines was already analyzed by the Final Supplemental EIS for the 2004 Sierra Nevada Forest Plan Amendment. The Record of Decision for that project provided the most recent direction applicable to the KRP when it replaced the 2001 decision with revised management direction. It is not necessary to revisit that decision at the project level. However this alternative addresses Issue #1: Large tree removal will have adverse effects to old forest dependant wildlife species.

It was eliminated from detailed study for the following reasons as related to the Purpose and Need in Chapter 1:

1. *Design treatments to facilitate timely and scientifically valid studies.* This alternative would not meet the purpose and need because the approach in the 2001 alternative restricts treatments to 20 inch dbh or less, limits treatment in PAC acres, and based upon current stand conditions, severely limits or eliminates treatments planned in 5 of the 8 management units planned for treatment. A more specific look at proposed management units indicates that two management units (krew_prov_1, and krew_bul) would receive little harvest and no change to target stand structure as a result of this alternative. Additionally, three other management units (glen_mdw_1, el_o_win, and bear_ fen_6) would have little to no stand changes. This alternative would not meet the purpose and need because there would be minor change and nothing to measure due to lack of disturbance within several of the planned study areas.

2. *Design treatments to protect and minimize impacts to Pacific fisher.* The short term impacts to Pacific fisher would likely be reduced compared to the proposed action. This is due to less habitat change and fewer acres treated.

   However the lower intensity treatment would include a higher risk of wildfire, insect attack, and loss of habitat associated with stand replacing events. The 2001 alternative is not feasible in many of the proposed stands due to proximity of improvements and current stand structure.

3. *Design treatments in accordance with the Kings River Project uneven-aged silvicultural strategy (Appendix C).* The 2001 decision specifies an upper thinning limit of 20" dbh and some places 6 inches and less. The 20" dbh limit equals no treatment in greater than 72 % of the growing space in the target structure. The growing space remaining and subject to management activities would be 28 % or less. Unplanned events or natural events then control the majority of stand structure and processes. The alternative considered here is not an uneven-aged treatment; it is a thinning from below.

   A cursory analysis utilizing stand FVS modeling reveals that this alternative would result in thinning from below alone in 96% of the stands identified for uneven-aged management (this excludes stands dominated by brush and young trees). The uneven-aged management must be able to remove trees from several age classes in the understory, the middle story, and the overstory. Uneven-aged tree removals are focused on the excess trees found outside the inverse J-shaped curve. This alternative focuses tree removals in excess of the inverse J-shaped curve and only on the understory and a small part of the middle story. An example is stand 1041 that shows removals would only take place in 14 inch dbh size trees leaving other size classes untreated.
   Thus the 20 inch limit is an arbitrary constraint that eliminates the use of the uneven aged management strategy.
   Figures 2-1 and 2-2 provide examples of existing forest conditions in two different stands. Each figure displays the structure or distribution of trees. The restriction imposed by the 20 "dbh and 6 "dbh limitations results in limited ability to alter stand structure. See Figure 2-2 that displays a rendering

of stand 1041. The rendering shows that trees less than 20" are found in the understory. Only six trees in the 14" diameter class would be removed in stand 1041. Clearly the implication is that only thinning from below occurs. Thinning from below will not, regardless of the number of treatments, move the stand structure to the inverse-J shaped target structure.

4. *Design treatments to increase resistance to a crown fire and stand replacing fires.* As described in the 2004 SNFPA ROD, the 2001 Framework decision prescribed technical solutions that did not produce needed results. While a 2001 alternative would reduce fuel ladders and ground fuels; where treatments were feasible it would leave crowns dense and vulnerable to crown fire. In the analysis of stands in past projects (Jose 1 project files, 2003) it was impossible to meet the Frameworks guidelines of 0.05 to 0.15 kg/m3 for crown bulk density to reduce the crown fire potential. The 0.07 kg/m3 crown bulk density is referred to by Agee as the critical crown bulk density for independent wildfire spread. The 2001 SNFPA decision did not allow managers to sufficiently treat dense stands to the guidelines proposed or those critical crown bulk densities identified by research. The 2001 framework would limit the methods to achieve fire hazard reduction to using only prescribed fire in stands that mapped Threat Zone in the wildland urban intermix and also California spotted owl Protected Activity Centers. In the Providen_4, Krew_prov_1, el_o_win, and soapro_2, this limits management tools to using wide-scale fire in previous untreated stands directly below homes, recreation residences, administrative sites, campgrounds, and Dinkey Recreation Area. In the 2004 SNFPA ROD managers identified these treatment restrictions and stand conditions as an unacceptable risk (USDA 2004).

5. *Design treatments to increase resistance to insect attack.* The 2001 alternative would leave trees in a dense condition due to the 20 "or 6 "dbh limitation. In figures 2-1 and 2-2 only understory trees would be remove leaving higher density levels in the middle and overstory trees. While the 20 and 6 " limit would adequately improve tree vigor in stands dominate by smaller trees (approximately 25 stands scheduled for treatment) the majority of treated stands (approximately 71 stands) would remain in a condition subject to epidemic insect attack and low stand vigor. The SNFPA 2004 Record of Decision emphasizes that actions are needed in key areas to reduce the risk of future tragedies, like the 2003 fires and massive insect outbreaks of Southern California and elsewhere in the West. Only reductions in tree density would give this.

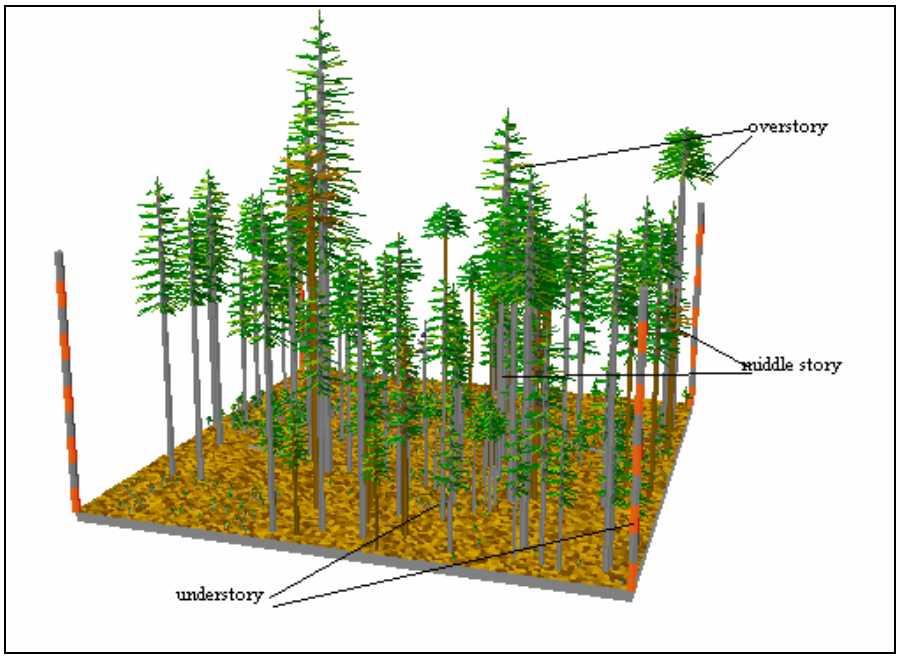

Figure 2-2 -

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the Table 2-20 is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 2-20 - Comparison and summary of alternatives

Purpose and Need	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3 (Reduction of Harvest Tree Size)
	****** indicates effects related to historical conditions for all alternative as this is the underlying purpose***		
Restore historical pre-1850 forest conditions across a large landscape.	*** The inverse J-shaped curve and the uneven-aged silvicultural strategy promote uneven-aged structures maintains existing age classes, creates new age classes, and maintains large trees in groups,. The inverse J-shaped curve promotes a tree distribution often described for the historical forest.	*** Moves the KRP area further away from pre-1850 conditions by taking no action at this time.	*** Also implements the inverse J-shaped curve but leaves more area subject to unmanaged conditions
Gain knowledge of uneven-aged silvicultural strategy & prescribed fire effects on wildlife habitat, wildfire behavior and watershed condition	Wildlife habitat: Implements the PSW CSOS and fisher monitoring to study the effects of implementing the KRP upon animal behavior Watershed condition: Implements KREW study; monitoring of Sediment Index “V*”; SCI, and presence of aquatic species; and adaptive management plan	The uneven-aged silvicultural strategy would not be implemented and the current ongoing research would not be completed. Knowledge on the effects of the uneven-aged silvicultural strategy on wildlife habitat and watershed condition would not be increased.	Same as Alternative 1

Purpose and Need	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3 (Reduction of Harvest Tree Size)
Increase the number of large trees (<35" dbh)	Over time the number of large trees increases (30 years) ****** Large trees dominated the historical forest. The alternative increases large tree dominance 4% more than Alternative 2.***	Fewer large trees than either Alternative 1 or 3 in the 30 year period, because trees are left in dense conditions with less growing space, more competition with smaller trees, and fewer grow into the large size class. No changes in growing space occur beyond the natural process found in an unmanaged stand. ****** Large trees dominated the historical forest. Small trees continue to dominate the management units.***	Same as Alternative 1, except slightly (approximately 2%) more large trees. ****** Large trees dominated the historical forest. The alternative increases large tree dominance 6% more than Alternative 2.***
Reduce tree density	Reduces area subject to insect mortality the most by removing 60% of trees < 11" dbh (After treatment, 14 % plots over SDI threshold) ****** Increases resistance to insect attack and crown fire.***	Area subject to insect mortality increase over time (27% plots over SDI threshold) ***** Dense canopy and fuel ladders remain and vulnerability to stand replacing crown fire and insect attack continues.**	Similar to alternative 1, except slightly more area is left subject to insect mortality (15% plots over SDI threshold) ****** Increases resistance to insect attack and crown fire.***
Protect adjacent landowners from wildfire	322 acres subject to active crown fire. The potential for crown fire is reduced through thinning, removing ladder fuels and disposing of treatment created fuels. Approximately 9000 acres treated in WUI. Approximately 1865 acres of DFPZ created. ****** Increasing resistance to crown fire allows for sustainable growth of larger trees and maintaining them over time.***	4200 acres subject to active crown fire. No DFPZ created under this alternative ***** Dense canopy and fuel ladders remain and vulnerability to stand replacing crown fire and insect attack continues.**	Same as Alternative 1

Purpose and Need	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3 (Reduction of Harvest Tree Size)
Re-introduce fire	Prescribed underburns on approximately 4685 acres under this decision; some overlap with 17,300 acres planned under existing decisions ****** Frequent low intensity fire was characteristic of the historical forest. This alternative uses prescribed fire, but it is at a lower frequency than the historical forest.***	Prescribed underburning on 0 acres under this decision. The 17,300 acres under existing decisions would still occur. *****Both severe stand replacing fire and the loss of large trees across so many acres is out of character with the historical forest condition.**	Same as Alternative 1 *****same as Alternative 1**
Control noxious and non-native weeds	Treats 39 acres of existing populations, and include measures to reduce risk of invasion The noxious weed species described in the proposed action for each unit will be treated, and are expected to diminish over time as a direct result of chemical and manual control treatments. Eradication is likely for the lens-podded hoary cress in Glen_mdw_1.	Known existing populations are not treated. Wildfire has the potential to cause significant disturbance to soil, ground cover, and canopy cover, placing at risk Forest Service sensitive riparian species that normally do not regenerate from high-intensity fires.. Stand replacing fire can also allow the opportunity for the spread of invasive weeds, which can affect Forest Service sensitive species through competition of resources.	Same as Alternative 1
Create reforestation groups	613 acres of reforestation groups and openings, limited to 3 acres each in size, planted with shade intolerant species and maintaining existing oaks. ******This alternative creates regeneration in groups and plants existing openings. Regeneration in groups is often described for the historical forest and allowed the dominance by shade intolerant pines and oaks.***	Does not plant any acres. Natural regeneration continues dominated by shade tolerant species *****Regeneration in the understory continues to be dominated by shade tolerant cedar and fir creating fuel ladders.**	521 acres of existing openings, no matter how large, planted with shade intolerant species and maintaining existing oaks. ******This alternative plants existing openings. Regeneration in groups is often described for the historical forest and allowed the dominance by shade intolerant pines and oaks.***

Purpose and Need	**Alternative 1 (Proposed Action)**	**Alternative 2 (No Action)**	**Alternative 3 (Reduction of Harvest Tree Size)**
Control competing vegetation	Competing vegetation is controlled in regeneration groups and planted openings up to on 613 acres to enhance survival and growth of planted trees Competing vegetation is controlled on 1976 acres within existing plantations *****supports restoration of historical forest condition by insuring survival/growth of pine and oak.**	Brush will continue to dominate openings and pose continued fire hazard within existing plantations *****openings will continue to be dominated by brush and shade intolerant species.**	Control competing vegetation on planted openings on 521 acres. Existing *****supports restoration of historical forest condition by insuring survival/growth of pine and oak.**
Improve watershed condition	Repair 22 documented WIN sites	No improvements. The actively eroding WIN sites identified for restoration would continue to produce sediment until another means of restoration is identified.	Same as Alternative 1 plus implements design measures to specifically reduce the hydrologic connectivity of existing roads
Issues	**Alternative 1 (Proposed Action)**	**Alternative 2 (No Action)**	**Alternative 3 (Reduction of Harvest Tree Size)**
Large tree removal effects to old forest dependant wildlife species. With three indicators or factors used to assess consequences--→	Basal area trees >35" dbh ~ 500K ft^2 after 10 years, ~ 600k ft^2 after 30 years # trees remove 30"-35"dbh ~ 4.3k # trees remove 20"-30" dbh~ 24k # Hazard trees removed ~ 500 trees (most over 35" dbh) Potential wildfire and prescribed fire severity on large trees> 35" dbh: ~580k ft^2 after fire	Basal area trees >35" dbh ~ 500K ft^2 after 10 years, ~ 590k ft^2 after 30 years # trees remove 30"-35" dbh~ 0 # trees remove 20"-30" dbh~ 0 Potential wildfire and prescribed fire severity on large trees> 35" dbh: ~210k ft^2 after fire	Basal area trees >35" dbh ~ 500K ft^2 after 10 years, ~ 600k ft^2 after 30 years # trees remove 30"-35" dbh~ 0 # trees remove 20"-30" dbh~ 24k # Hazard trees removed ~ 500 trees (most over 35" dbh) Potential wildfire and prescribed fire severity on large trees> 35" dbh: ~585k ft^2 after fire

Purpose and Need	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3 (Reduction of Harvest Tree Size)
Herbicide risk to Human health and wildlife	No adverse health effects from directed spraying of glyphosate;. State water quality objectives met. Design measures reduce inadvertent exposure to humans and wildlife. The risks of negative reproductive effects to workers and to members of the public are low. No adverse effects from smoke. Unlikely adverse effects to terrestrial or aquatic wildlife due to design measures and low mobility in soil.	No chemical use. No adverse health effects to humans or wildlife. State water quality objective met.	Same as Alternative 1
Viability and habitat of spotted owl, marten fisher and goshawk indicators used A) Tree canopy cover (medium and large trees) > 50%	A) Tree canopy cover ~ 40 percent	A) Tree canopy cover ~ 43 percent	A) Tree canopy cover ~ 41 percent

Purpose and Need	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3 (Reduction of Harvest Tree Size)
Viability and habitat of spotted owl, marten fisher and goshawk indicators used B) Population viability: spotted owl, marten fisher and goshawk	B) All species: may affect, but is not likely to lead to federal listing or loss of viability. Spotted owl maintains very good potential for reproduction; marten unlikely to reproduce in project area, due to outside habitat range; Fisher reproduction is occurring, population is stable. More areas used for resting and denning removed than Alternative 3. Goshawk: Approximately two percent of the suitable habitat within the KRP area and less than one percent of the suitable habitat on the Forest would be affected by the action alternatives. Alternative 1 will move the habitat closer to high suitable habitat and reduce the habitat fragmentation due to wildfire.	All species: may affect, but is not likely to lead to federal listing or loss of viability. Taking no action maintains or exacerbates the current effects of stand-replacement fire over time – leading to a potentially greater loss of suitable habitat should one or more fires occur within the planning area.	B) All species: Same as Alternative 1 Spotted owl: Same as Alternative 1 Fisher reproduction is occurring, population is stable. More areas used for resting and denning are protected under this alternative. Goshawk: Same as Alternative 1

Purpose and Need	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3 (Reduction of Harvest Tree Size)
Viability and habitat of spotted owl, marten fisher and goshawk indicators used C) Suitable habitat: spotted owl, marten fisher and goshawk	C) Spotted owl habitat down ~ 7 acres per 300 acre PAC Marten: It is unlikely these mesocarnivores den in these units due to the elevation range of the species. If they are foraging or resting in one of these units, when trees are being removed with mechanical equipment (tractor, masticator, etc.) there may be a direct effect due to the noise disturbance involved with project activities. Fisher: Areas available for resting decrease, The eight management units currently contain 3415 acres CWHR types 4D and 5D, which will be reduced to 2418 acres. Goshawk: 9873 acres of suitable habitat exist in the project area. Implementing Alternative 1 would result in a loss of about 924 acres of suitable habitat. Following wildfire this alternative has lower severity and maintains more habitat than Alternative 2.	The eight management units contain habitat of CSO PAC, Fisher, marten, and goshawk remain unchanged. A high intensity fire under severe fire weather conditions would pose the risk of losing key habitat of Forest Service threatened, endangered and sensitive species, The choice of no treatment leaves the forest vulnerable.	C) Spotted owl same as Alternative 1 Marten: same as Alternative 1 Fisher: Areas available for resting decrease, The eight management units currently contain 3415 acres CWHR types 4D and 5D, which will be reduced to 2418 acres. Goshawk: 9873 acres of suitable habitat exist in the project area. Implementing Alternative 1 would result in a loss of about 924 acres of suitable habitat. Following wildfire this alternative has lower severity, maintains substantially more habitat than Alternative 2 and slightly more habitat than Alternative 1. .
Risks for aquatic management: Shading along streams - desired condition > 75%	Treatments lower existing shading, but shading meets the desired range of variability. Shading exceeds 50%.	No change from current condition	No change from current condition due to design criteria that limit disturbance along streams.
Risks for aquatic management: Shading along streams – water temperature	Tractor harvested areas results in no change from current condition. Helicopter harvested areas result in: 0.2° F increase in the Dinkey Creek watershed, and a 1.18 ° F increase in the Big Creek watershed.	No change from current condition	No change due to 50 ft buffer along class I SMZ.

Purpose and Need	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3 (Reduction of Harvest Tree Size)
Risks for aquatic management: Shading along streams – V* (increase in fine sediment in pools).	Slight risk of increase in V* With stand replacing fire there is a high risk of an increase in V*	No change from current condition With stand replacing fire there is a high risk of an increase in V*	Similar to Alternative 1

Adaptive Management

The Kings River Project represents the only adaptive management program currently established in the south half of the Sierra Nevada. The Forest Service believes that an uneven-aged silvicultural and prescribed fire strategy provides promise for effective forest restoration and future management.

The KRP is based on the following hypothesis: is an uneven-aged silvicultural strategy combined with a program of prescribed fire an appropriate and effective management choice for restoration of an ecologically healthy and fire resilient forest? This project is also intended to examine the response of some key forest elements such as sensitive wildlife species (Pacific fisher and California Spotted Owl), watershed processes, and aquatic species habitat.

The term "Adaptive Management" has been applied to many resource management situations and has acquired a variety of meanings through these various applications. In this context we intend a definition of passive adaptive management, that is an acknowledgement of the uncertainty of how the resource to be managed will respond and the corresponding need to learn in an iterative fashion as management is applied. This learning is produced by posing a management hypothesis, executing management at a suitable spatial and temporal scale, and enabling learning through collection and analysis of the appropriate kinds of data.

Adaptive management for the Kings River Project area involves the treatment of the initial eight management units as described by Alternative 1 and 3, establishing 10 units as no treatment-controls and the treatment of one unit (South of Shaver) under an existing decision. The remaining 60 units will be treated based on the results of monitoring and research. There are four topics following that refer to timing and gathering of information for adaptive management:

Adapt management of fisher habitat based on monitoring and new information:

Our primary objective of the fisher component of this project is to better understand what habitat these animals select/preferentially use within their greater home range and, in turn, how individual fisher respond to changes in habitat that result from both anthropogenic as well as natural influences. Forest ecosystems are inherently dynamic and heterogeneous; however, there are undoubtedly certain thresholds of habitat change below which wildlife populations are likely to suffer negative consequences. Through these adaptive management studies we are hoping to determine what forest management practices are suitable for maintaining and restoring forest conditions that support healthy populations of sensitive wildlife species such as fisher.

All conventional monitoring and research methods for studying this animal have different strengths and weaknesses. It is our intention, through collaboration with scientists at PSW, that the most effective means or combination of techniques be employed within this study, as described in the research section of this chapter. More than likely this will mean use of some kind of telemetry methods that will enable monitoring of a large number of locations, for numerous individual animals, over a period of pre and post treatment years. Large sample sizes of these "habitat use" data points, for a large sample

of individual fishers, are needed to address the uncertainty around habitat use/selection and the eventual response of animals to varying degrees of change within their home ranges. These data will be used to analyze use and response and to drive adjustments, as needed, to future treatment of additional management units.

Whatever combination of techniques is employed, our intention is to examine fisher habitat in the Big Creek and Dinkey Creek drainage's that include the initial eight KRP Management Units as well as untreated control sites. We will be monitoring fisher activities before, throughout the three major phases of treatments (logging, mastication, prescribed fire), and after treatments to determine fisher use of treated and untreated habitats.

Current plans for development and execution of this work include collaboration with the University of California and their efforts to address fisher in their Sierra Nevada adaptive management study that is planned for the nearby Fish Camp area, about 25 miles north of the Kings River Project area.

Adapt management of spotted owl habitat based on monitoring and new information:

Monitor spotted owls and their habitat as described in the California Spotted Owl (CSO) Study Plan. Our proposed design will monitor the effects of vegetation treatments at two spatial scales relevant to CSO. Continued monitoring of the density, distribution, survival, reproduction, and recruitment of CSO across the entire project area will provide a measure of change in CSO population size across time as the landscape is moved towards the desired future condition, the historical pre-1850 forest conditions. The landscape data are necessary and critical for addressing the most fundamental management question. That is, can the long-term viability of CSO be maintained on landscapes managed under an uneven-aged silvicultural strategy and prescribed fire to restore historical forest conditions, improve forest health and develop a sustainable level of productivity? Further, the landscape perspective is necessary to discern movements of individual CSO among territories in response to treatments. Monitoring of important environmental co-variates such as the distribution and abundance of vegetation and annual weather parameters such as temperature and precipitation will be conducted and are necessary for determining the association between vegetation changes, weather, and changes in CSO response.

The second relevant spatial scale is at the home range scale occupied by a pair of CSO. At this scale we propose to monitor the response of CSO pairs to treatment of their PAC (approximately 300 acres) and circular home range core areas. The Sierra NF estimates that 9 Management Areas (one is the South of Shaver project) will be treated in the first 5 years of the KRP. These projects will treat portions of 8 occupied CSO home ranges and 4 unoccupied PACs/home ranges that were occupied in past years. Attempts will be made to treat all of the PAC and home range core area for each CSO home range, although private land in-holdings and areas that can not be feasibly treated due to topography or other factors may not receive treatment. As part of the landscape monitoring of CSO density, distribution and demographics we will annually monitor CSO occupancy, survival, and reproduction on the treated territories to monitor treatment effects and the association between vegetation changes and CSO response.

Should additional funding become available, it is possible to garner further insight on CSO response at the home range scale by incorporating a radio-telemetry component. The benefit of this investment would be greater insight into how CSO respond during actual treatment implementation and, more importantly, how pairs of CSO use specific habitat patches within their home ranges prior to and following treatments. Knowledge of habitat use by CSO within their home ranges is a major area of scientific uncertainty in current understanding of CSO habitat associations and is an important data need. These data are necessary to understand the structure and composition of habitat patches within an overall home range that are selected by CSO for foraging and roosting. Knowledge of these habitat associations can lead to better-informed management and specific recommendations for providing suitable foraging habitat for CSO

Adapt management of aquatic species habitat based on monitoring and new information:

Provide analysis of stream condition to inform and adapt subsequent site-specific NEPA analyses and decisions. Conduct Stream Condition Inventory (SCI) Monitoring (Frazier and others 2005), Properly Functioning Condition Assessment (USDI 1998), and V* sediment ratings (Hilton and Lisle 1993) at the following intervals in at least one stream reach of each of the management units and phased in over a three year period, the control units:

- pre-project implementation
- 1-year after implementation of project begins whether or not a major phase is completed
- 1-year after each of the three major phases of treatments (e.g. logging, mastication, prescribed fire) are completed in a unit
- every 3- to 5-years after the three major phases are completed in a unit with corresponding samples in the controls for the life of the Kings River Project
- after significant flow events occur (if between monitoring intervals)

For the Yosemite toad, monitoring will occur using the intensive monitoring protocol developed by Cathy Brown (Amphibian Team Leader for Region 5). This protocol was developed to monitor tadpole and newly metamorphose toad demography and microhabitat. Monitoring will include counting of life stages, adults, and egg masses during spring breeding. Microhabitat data for each life stage will also be collected. A telemetry study for the Yosemite toad has been initiated in 2006 but still needs further development. The goal is to gain a better understanding of the basic ecology of the Yosemite toad and its response to forest management treatments. This study would need to be continued in 2007 and expended into other occupied areas of the Kings River Project. Control stands surrounding occupied meadows will likely need to be established for this study. The monitoring for the Yosemite toad will need to occur on an annual basis for the life of the Kings River Project.

Adapt implementation design measures of sub-watersheds that are currently below but projected to exceed their lower Threshold of Concern as a result of the addition of ERA resulting from project activities:

Fifteen sub-watersheds that are currently below their TOC for Cumulative Watershed Effects (CWE) will exceed their threshold after project implementation. These sub-

watersheds will be evaluated in a Detailed Assessment (see description of CWE assessment process in the Watershed section of Chapter 3) after each phase of implementation in order to determine whether the project has resulted in increased risk of a CWE response. If at any time these sub-watersheds are found to be at increased risk for CWE response, the design measures that apply to sub-watersheds that are over their TOC prior to implementation of this project will be applied to the remaining phases of implementation.

The fifteen sub-watersheds whose management will be adapted according to this plan are identified in Table 3-46 and include: 519.0007; 519.0008; 519.0009; 519.0011; 519.0056; 519.3002; 519.3003; 519.3004; 519.3052; 520.0015; 520.0016; 520.0056; 520.0057; 520.3002; and 520.4051.

Additional sub-watersheds may be evaluated for CWE response based on factors other than from the ERA model. This will be developed through adaptive management techniques.

Monitoring

Monitoring is critical component of each of the action alternatives. Specific resource monitoring includes the following types of monitoring:

Implementation Monitoring

Implementation monitoring includes a combination of administrative controls on project preparation, review of completed plans, and inspections during operation to ensure that project activities are accomplished consistent with any decision associated with this analysis. Administrative controls include having qualified staff prepare contracts and plans to implement the actions. Those plans are reviewed by higher level staff or Line Officers to ensure the plans include required resource protections measures. Project implementation is overseen by qualified staff with the delegated authority to make sure the project is implemented according to the approved plans, and to take corrective action during project implementation if actions are not in compliance with the approved plans.

Effectiveness Monitoring

Effectiveness monitoring includes site review after treatments to determine if the required measures achieved the intended results. Examples include post burn surveys to determine if adequate ground cover remains after treatment. The protocols associated with the Best Management Practices Evaluation Program (BMPEP) will be applied concurrently with treatments to provide “real time” monitoring of the effectiveness of water quality protection measures.

Monitoring requirements for the action alternatives are detailed in Appendix B.