**Figure 2-23. N_Soaproot_2, Land Allocations and Designations**

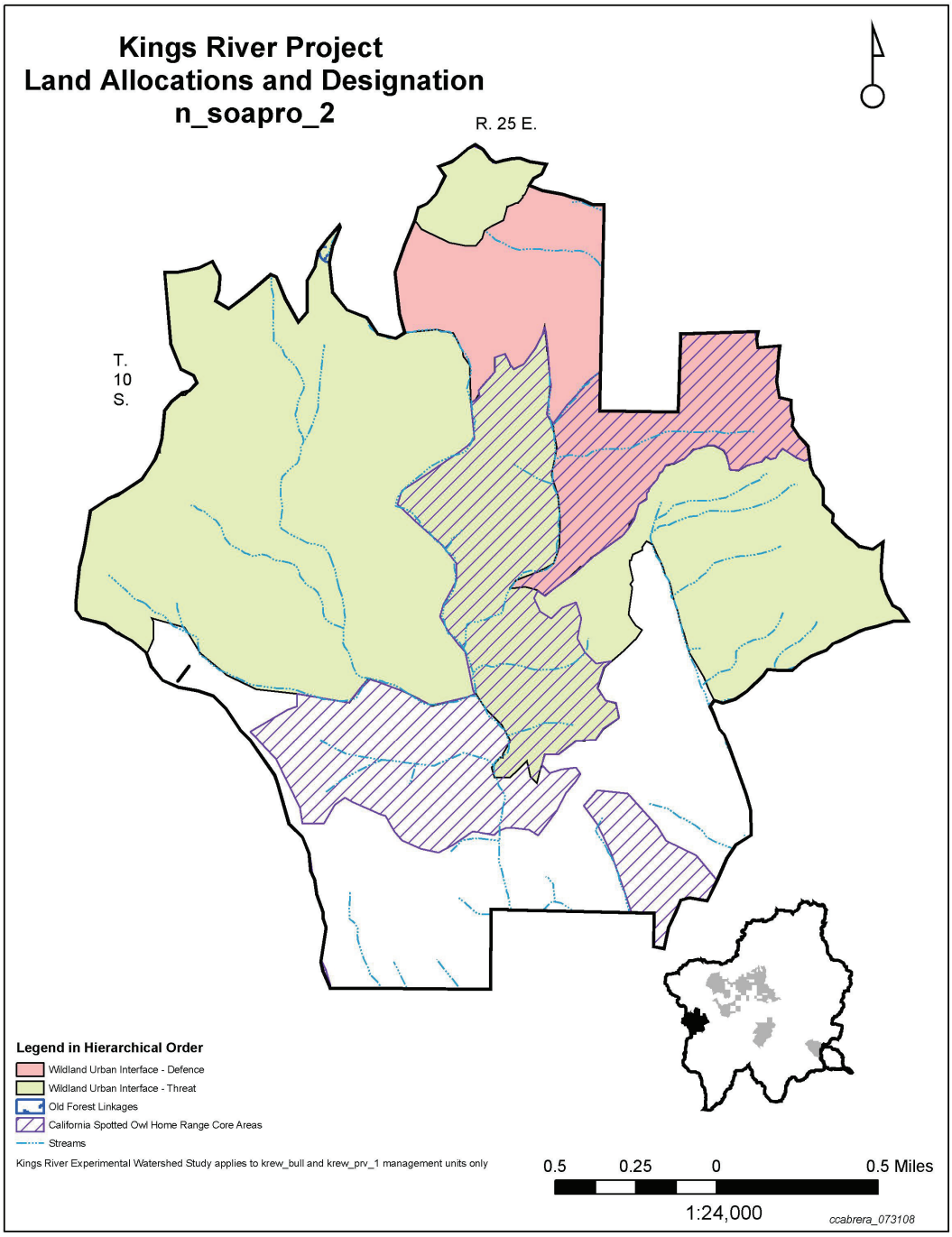


**Figure 2-24. N_Soaproot_2, Aquatic Allocations and Designations**

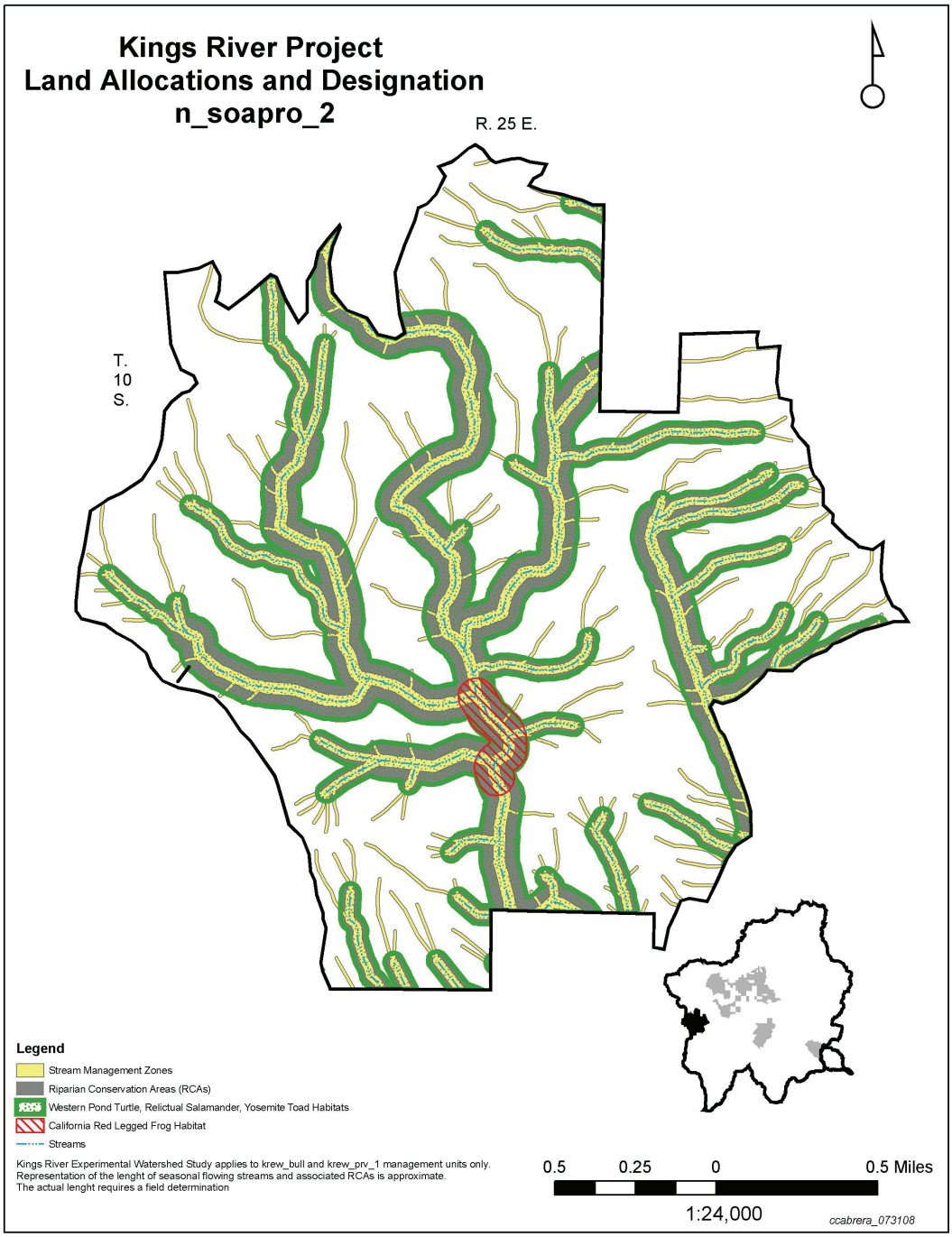


**Figure 2-25. N_Soaproot_2, All Treatments**

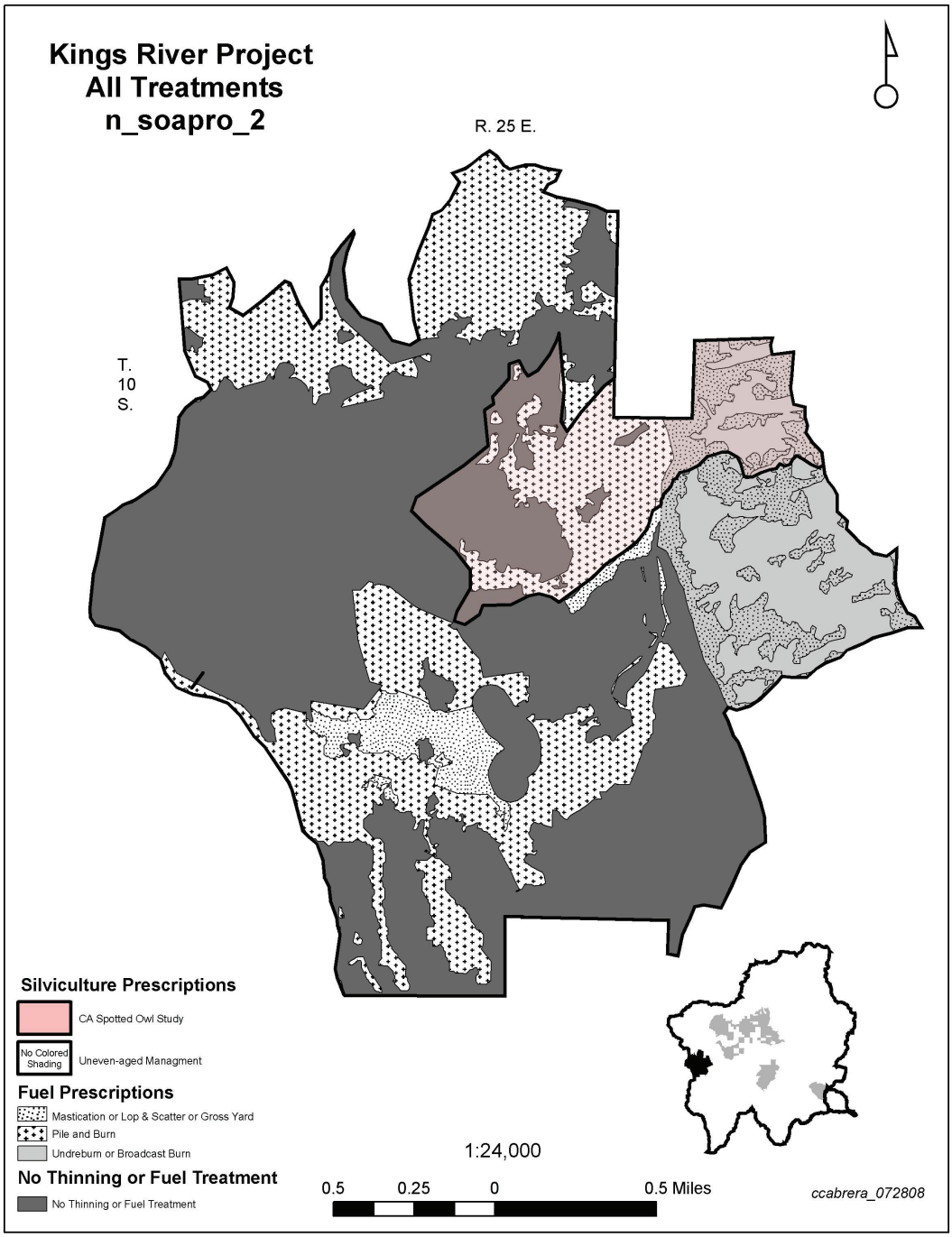
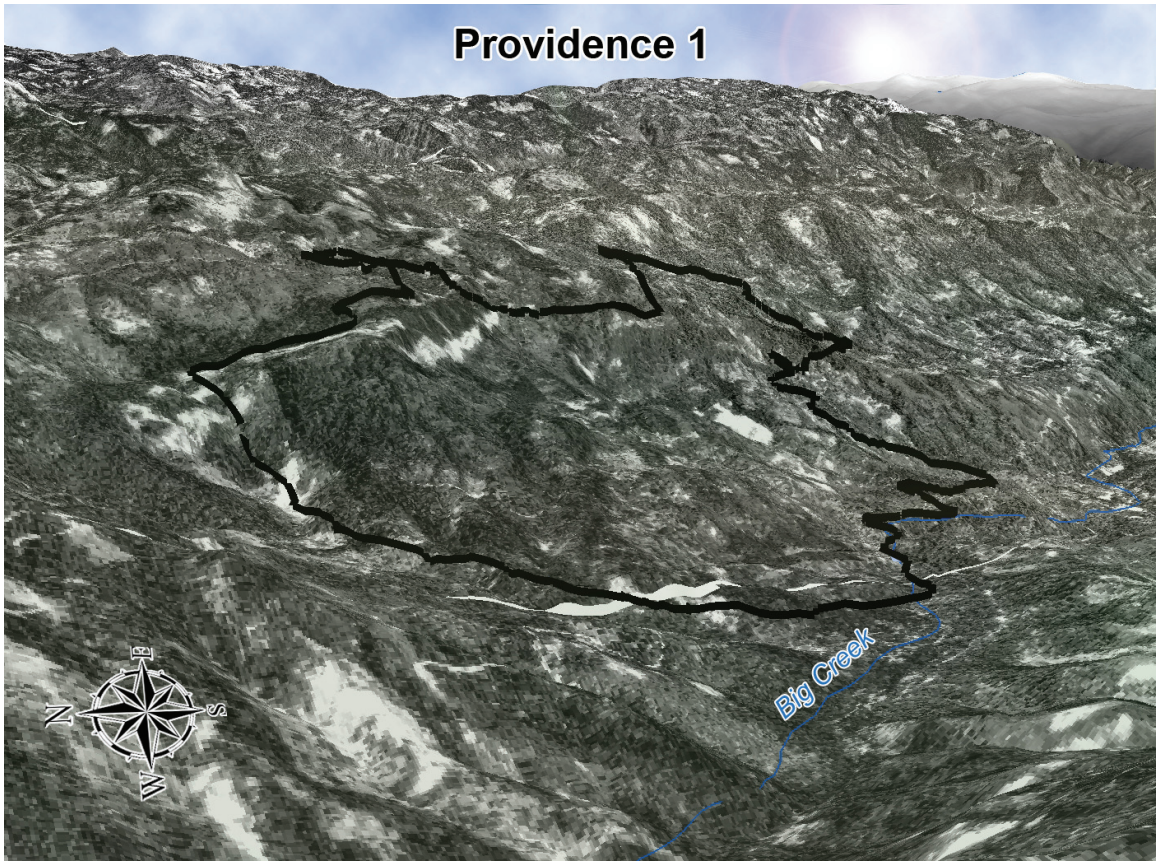


**Figure 2-26. Providence_1 Management Unit (Prov_1) - 2,015 acres**

Elevation: 3,600 to 5,900 feet




Vegetation in Providence_1 is a mosaic of ponderosa pine, black oak, and brush fields. Unit vegetation is a result of the 1947 Bretz fire. Ponderosa pine is dense in pockets. Oaks are located on steeper slopes. Brush fields are dominated by deer brush and white leaf manzanita. This management unit is entirely within WUI defense and threat zones.

Five infestations of bull thistle have been identified in Providence_1.

Nine WIN sites have been identified.

Two hundred and thirty-seven acres of Providence_1 are proposed for treatment as part of the California Spotted Owl Study.

This unit and the Kings River area are being monitored by PSW and the Region for fisher. Few fishers have been detected in this unit.

**Figure 2-27. Providence_1, Land Allocations and Designations**

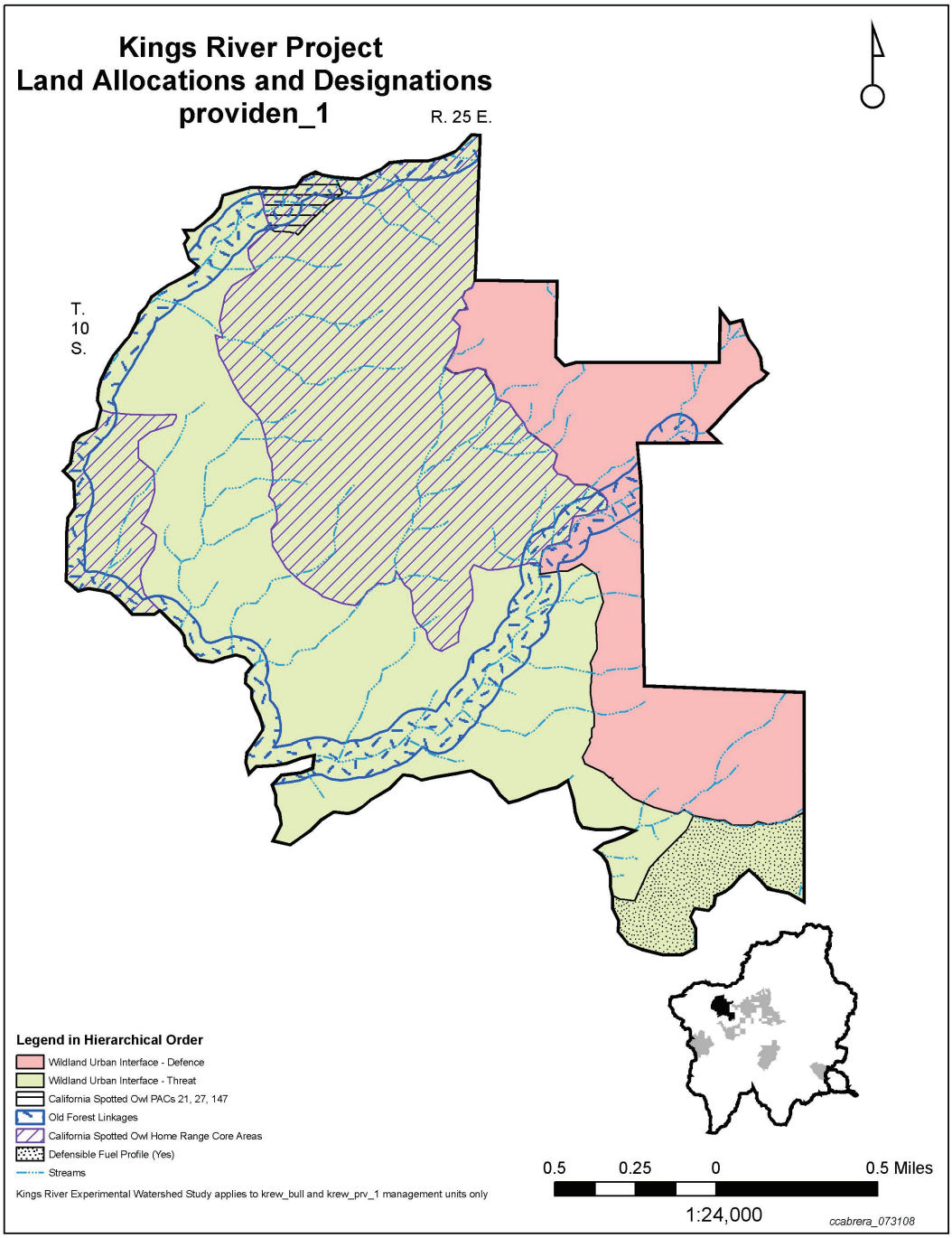


**Figure 2-28. Providence_1, Aquatic Allocations and Designations**

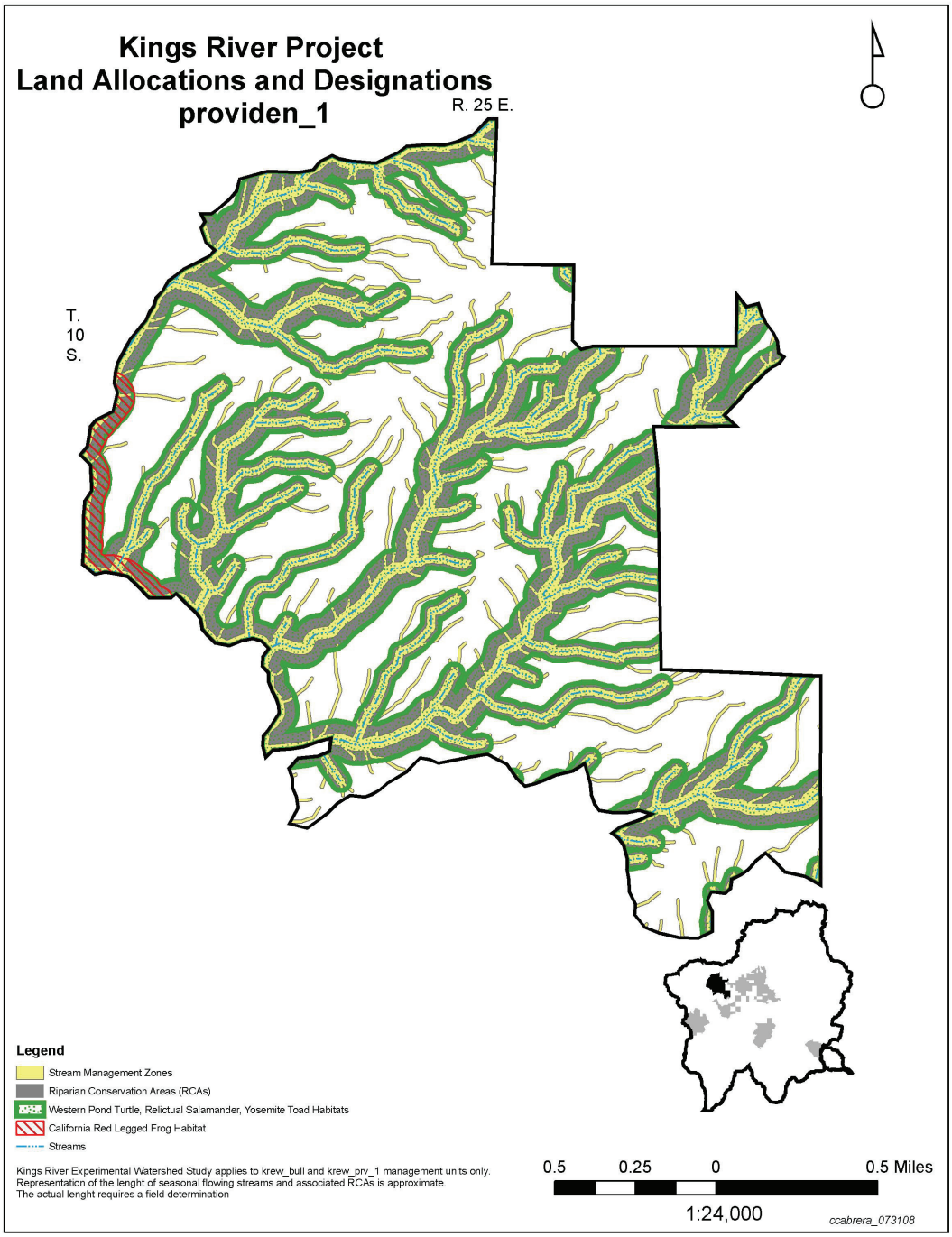


**Figure 2-29. Providence_1, All Treatments**

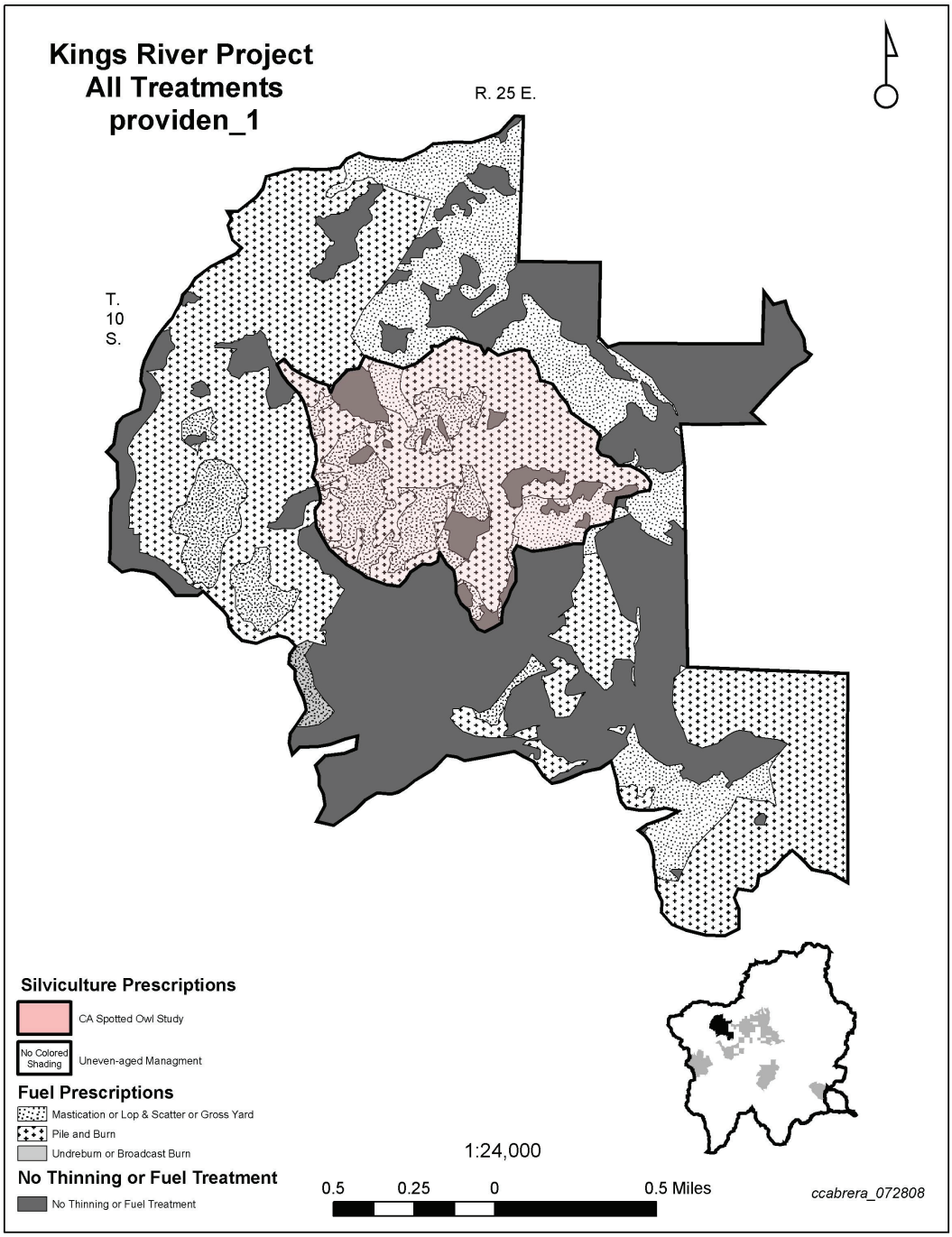
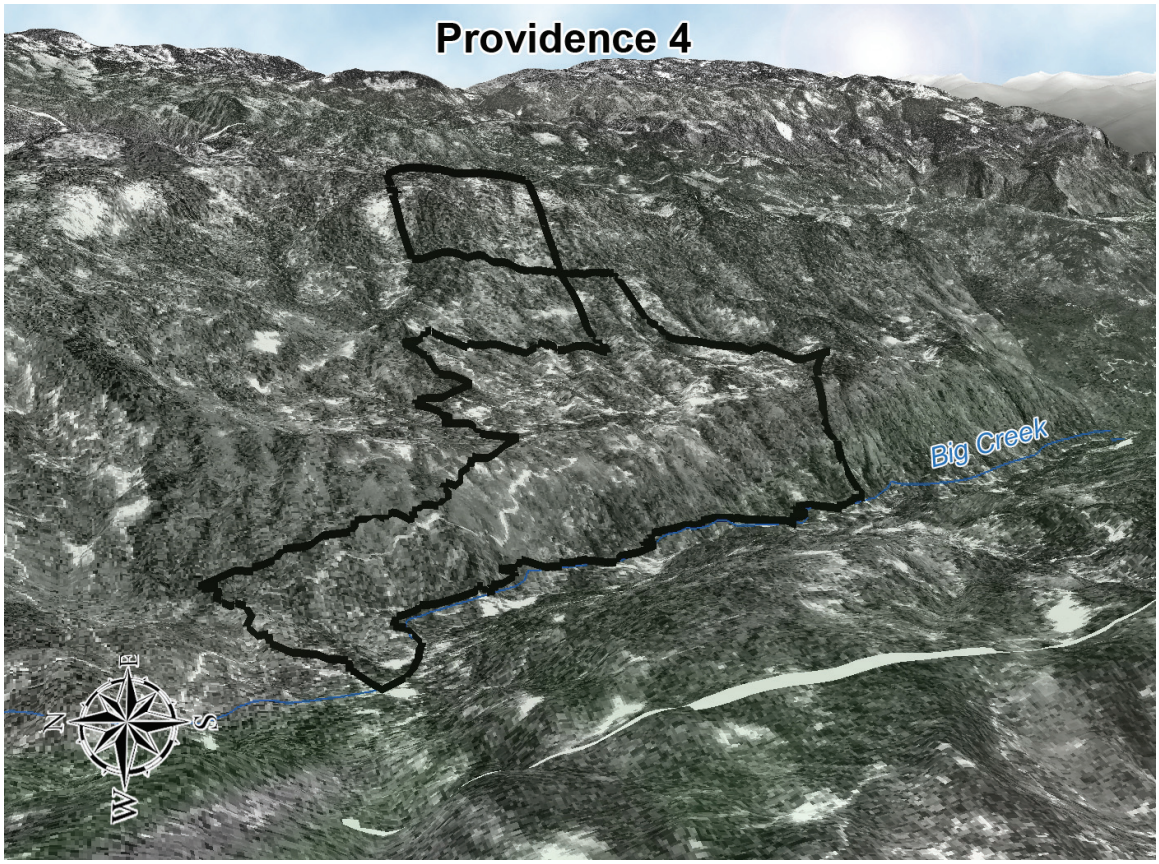


**Figure 2-30. Providence_4 Management Unit (Prov_4) - 1,049 acres**

Elevation: 3,200 to 5,900 feet




This management unit is similar to Providence_1 Management Unit with a mosaic of ponderosa pine, black oak, and brush fields. Ponderosa pine is dense in pockets. Oaks are located on steeper slopes. Brush fields are dominated by deer brush and white leaf manzanita. Chaparral and live oak dominate one stand.

One bull thistle infestation was found in this unit. Spanish broom grows along road 10S18.

No treatments associated with the California Spotted Owl Study are proposed in this unit.

This unit and the Kings River area are being monitored by PSW and the Region for fisher. Pacific fisher is present in this unit.

**Figure 2-31. Providence_4, Land Allocations and Designations**

**Figure 2-32. Providence_4, Aquatic Allocations and Designations**

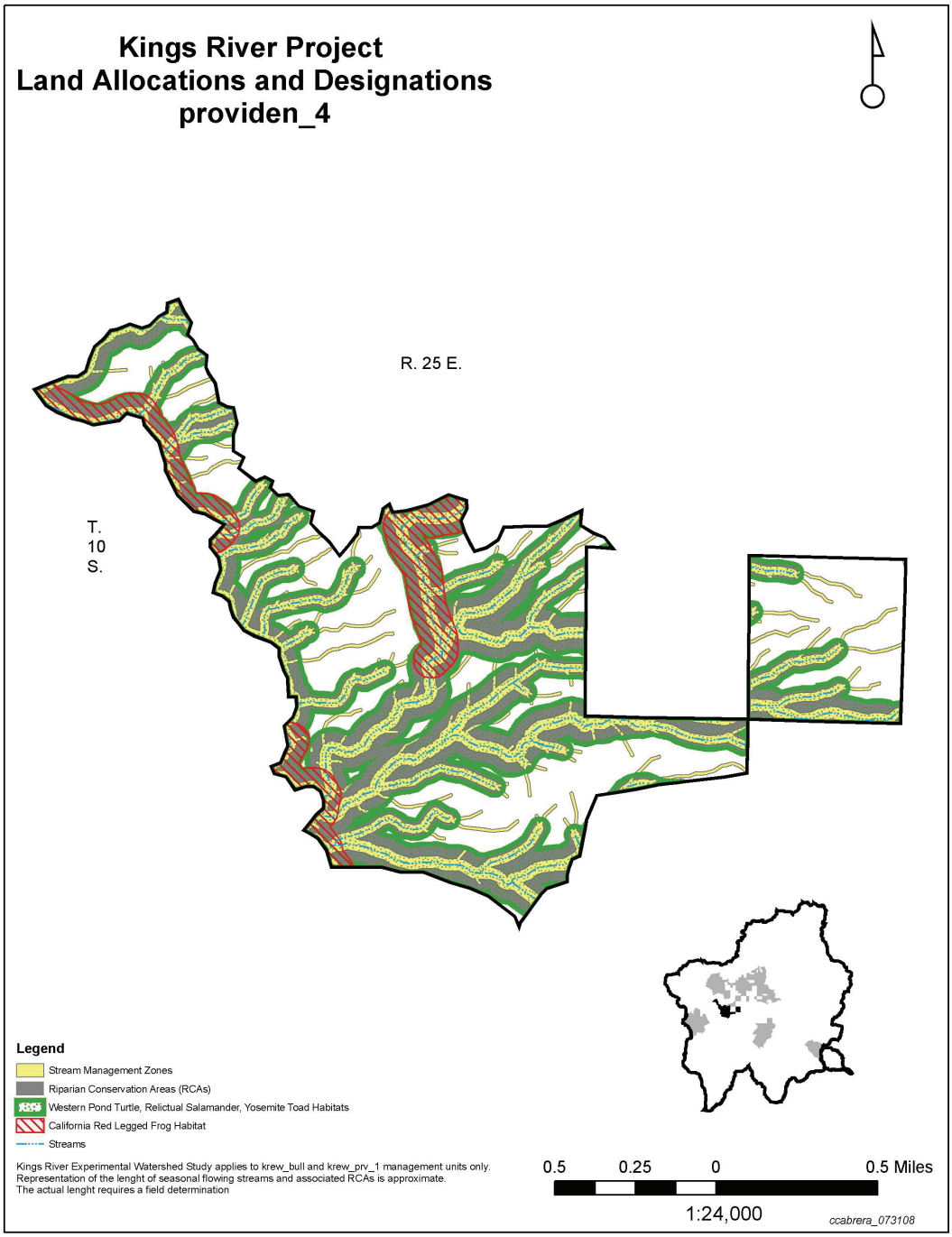
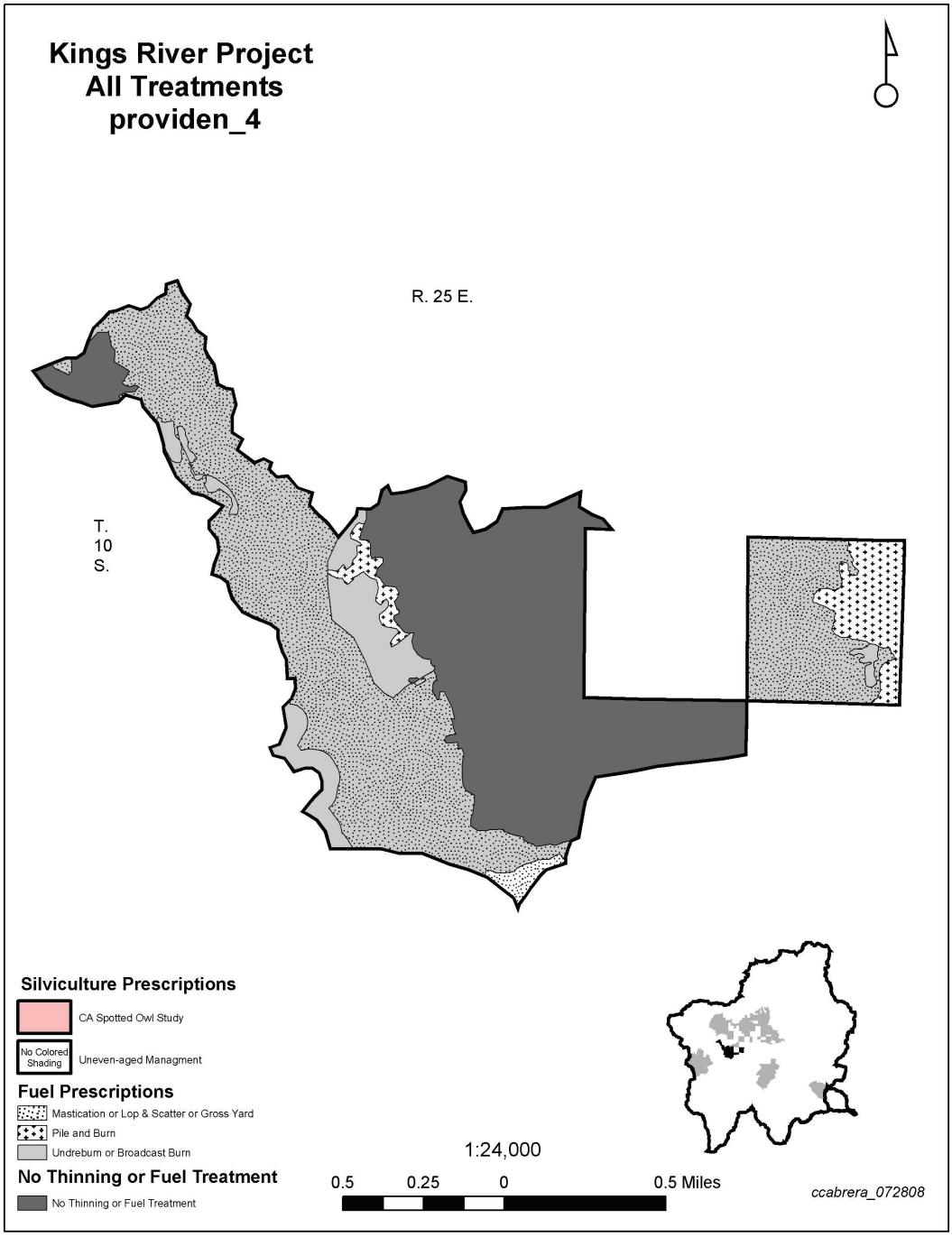


**Figure 2-33. Providence_4, All Treatments**



## Alternatives Considered

Four action alternatives were developed to achieve the purpose and need based on issues identified through public comment, earlier proposals, and ongoing collaboration. In addition, a No Action alternative was analyzed. This section describes each of these alternatives in detail.

Alternatives 1, 3 and 4 offer treatments intended to return the forest in the Kings River Area to a more resilient, natural mix of species and age classes. These treatments were developed with the Pacific Southwest Research Station (PSW) to minimize anticipated adverse impacts of physical change while creating a resilient forest. This resilient forest would be similar to forests that had developed under pre-1850 conditions. This condition is believed to be the most resilient to unknown future effects. Alternative 5 provides the opportunity to consider treatmensts compatible with the 2001 version of the Sierra Nevada Forest Plan Amendment. Climate change may already be having an effect on the forest in the Kings River area and throughout the Sierras. They are constantly changing in their appearance and in their utility for a wide variety of wildlife and human use. Nothing stays the same on the landscape. Natural changes such as wildfire, windstorms, or insect attacks can alter an entire forest in a few days or months. Human activities such as development or timber harvest can also produce profound effects. Short-term changes could be erased by growth. Longer term changes may be irreversible if species are lost. These factors will be used in comparing alternatives.

The vulnerability of the Pacific fisher population in this area is very real. One threat is from catastrophic wildfires. Each action alternative strives to produce a more resilient landscape that would support all indigenous species with special consideration for the Pacific fisher. Changing the forest to a more resilient, natural condition with fire as a more natural, balanced component would require disturbance of some kind. The following alternatives have been developed to examine several ways to bring about this change.

### Alternative 1 – The Proposed Action, Uneven-aged Strategy

Alternative 1 proposes implementation of commercial and noncommercial thinning, site preparation, planting, release, and fuel reduction treatments as described in Appendix E. Development of defensible fuel profile zones, noxious weed treatments and watershed restoration projects are also proposed.

Implementation of this alternative would require an amendment to the Sierra National Forest Land and Resource Management Plan (LRMP) Standards and Guidelines to allow the harvest of trees up to 35 inches in diameter and the creation of forest canopy openings for regeneration. The harvest of relatively large trees (30 to 35 inches dbh) in a stand is proposed to stimulate the growth of even larger trees as well as trees 20 to 30 inches in dbh. Less than 10 percent of the existing trees between 30 and 35 inches dbh would actually be removed. Small (less than three acres) regeneration harvests focusing on existing groups with sparse or no canopy cover would be permitted. This alternative would allow the Kings River Experimental Watershed (KREW) study, the California

spotted owl study, and fisher studies to proceed as planned. Most of these would require Forest Plan amendments to implement their respective study plans. The silvicultural study does not require an amendment.

Specific treatments (See Table 2-4 for a summary of treatments among alternatives, and Table 2-8 for a comparison of alternatives) for Alternative 1 include:

1. Commercial harvest of merchantable wood using tractor and helicopter logging systems
2. Noncommerical thinning including mechanical or hand thinning
3. Bunching material for removal or for subsequent piling and/or burning
4. Site preparation including mechanical methods such as shredding and tractor piling; manual methods including hand grubbing, hand removal of material, handpiling of material; burning; and ground applications of glyphosate from backpack sprayers
5. Planting including hand planting and replanting or interplanting
6. Release methods including mastication/shredding, hand grubbing, hand brushing, and glyphosate application from backpack sprayers
7. Fuel reduction treatments including mastication/shredding; hand/tractor/grapple piling; crushing; lop and scatter; broadcast burning; under burning; pile burning; and jackpot burning
8. Defensible fuel profile zone (DFPZ) construction would include thinning, tractor piling, mastication, and under burning and would be maintained through hand thinning, tractor piling and under burning
9. Noxious weed treatments including glyphosate application from backpack sprayers and mechanical or hand pulling
10. Watershed restoration projects ranging from stabilizing headcuts to closing and rehabilitating roads, Tables 2-1, 2-2, and 2-3
11. Road treatments would include approximately 190 miles of road maintenance; about 84 miles of road reconstruction; and 2 miles of new road construction

**Table 2-1**. **Watershed Restoration Projects - Providence_1**

| Map # | Description | Proposed Repair |
|---|---|---|
| 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* use – gullies -sedimentation into streams | Either mitigate sedimentation or close - subsoil and install waterbars |
| 54438 | | |
| 54439 | | |
| 54440 | | |

*Off-Highway Vehicle (OHV)

**Table 2-2. Watershed Restoration Projects - N_soaproot_2**

| Map # | Description | Proposed Repair |
|---|---|---|
| 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<br>54274 | Erosion from OHV trail (extension of 10S43) contributes sediment to Rush Creek | Evaluate route - either mitigate erosion or close and rehabilitate route |

**Table 2-3. Watershed Restoration Projects - Bear_fen_6**

| Map # | Description | Proposed Repair |
|---|---|---|
| 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 |

**Alternative 2 – No Action**

Alternative 2, the No Action Alternative, reflects a continuation of all previously approved actions. The No Action Alternative authorizes no new actions as a result of this project.

**Alternative 3 – Retain Largest Trees, Uneven-aged Strategy** (The previous name for this alternative was Reduction of Harvest Tree Size. Alternative 3 may be discussed in specialist's reports under that name.)
Alternative 3 is similar to Alternative 1, except for the following changes, (See Table 2-4 for a summary of treatments among alternatives, and Table 2-8 for a comparison of alternatives):

1. Alternative 3 has a 30-inch maximum diameter limit for the removal of trees (the limit in Alternative 1 is 35 inches)
2. A reduction of approximately 90 acres in planting
3. Small regeneration harvests would not be used, (approximately 90 acres)

**Alternative 4 – Fisher Emphasis**

Alternative 4 is designed to minimize short-term impacts to Pacific fisher to protect their long-term survival. See Table 2-4 for a summary of treatments among alternatives, and Table 2-8 for a comparison of alternatives. The following actions are different in Alternative 4 compared to Alternative 1:

1. Implementation of a Limited Operating Period (LOP) in the Southern Sierra Fisher Conservation Area (which goes beyond the LOP required as a part of the SNFPA, 2004 for known den sites)
2. Emphasized retention of key habitat groups and the maintenance of habitat functionality by implementing the PSW/Cedar Valley silvicultural strategy (Appendix H)
3. Reduce approximately 90 acres of planting (See Table 2-8)
4. Small regeneration harvests would not be used, (approximately 90 acres)
5. Alternative 4 calls for a 30-inch maximum diameter limit for the removal of trees (the limit in Alternative 1 is 35 inches)
6. Amend the Southern Sierra Fisher Conservation Area boundary to reflect the CBI 2008 boundary for this area (depicts the land that contains 85 percent of all known fisher detections)

The Interdisciplinary Team (IDT) has created Alternative 4 to respond to new emerging information regarding how to protect Pacific fisher and to create a resilient forest capable of adapting to an uncertain future caused by changing climate. The IDT has consulted extensively with agency professionals and scientists and knowledgeable community members. Their contributions have directed the design of this alternative.

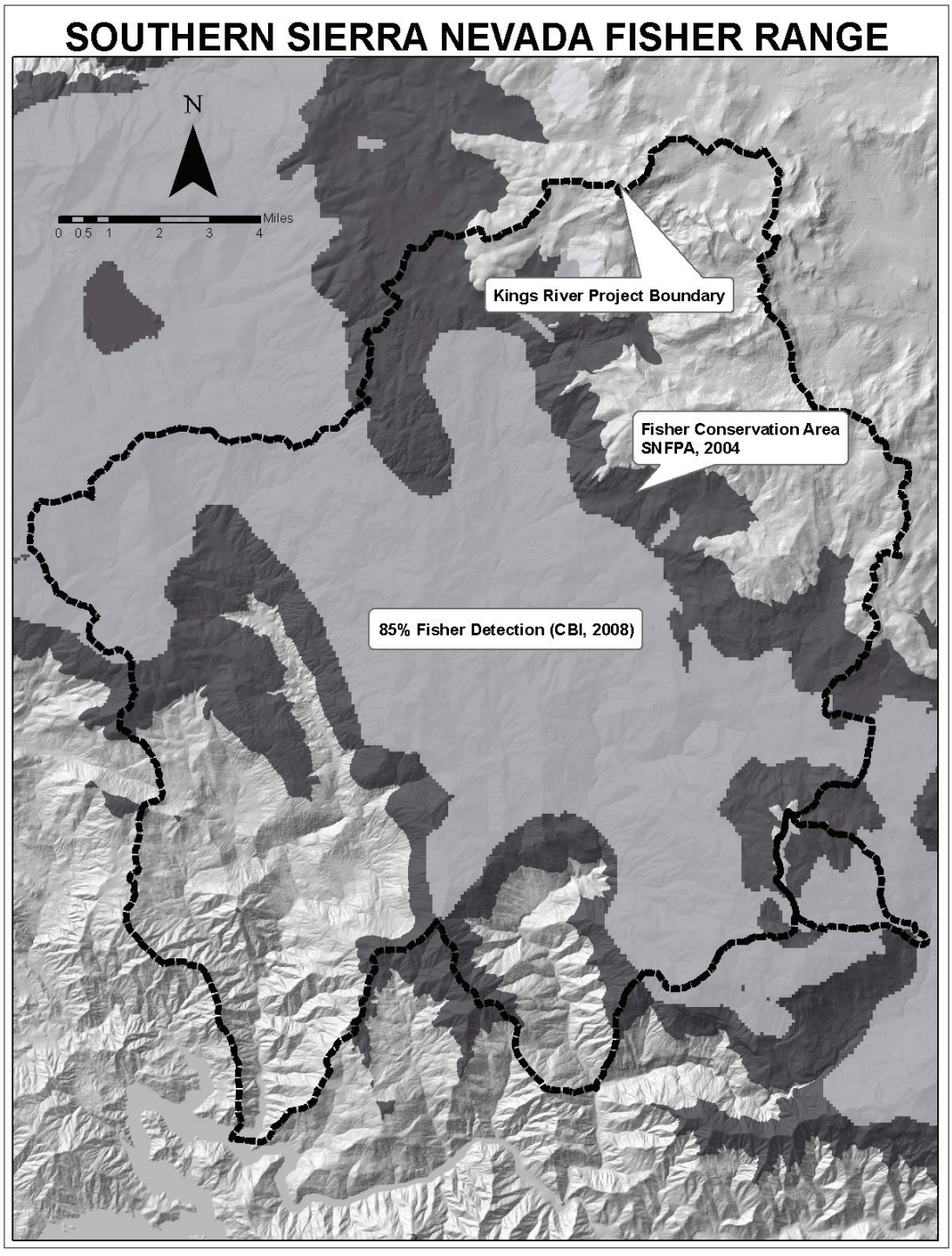
Alternative 4 is designed to utilize the Pacific Southwest Experiment (PSW) Station's recommendations for creating resilient forest conditions by emphasizing ecological process (see Appendix I) and incorporating relevant aspects of work on Cedar Valley's silvicultural strategy (see Appendix H). This alternative also includes a refined Southern Sierra Conservation Area using CBI's new modeling of Pacific fisher habitat preferences.

This prescription applies to areas in the Wildland Urban Interface (WUI) Threat zones and to areas outside of WUIs. This prescription does not apply to WUI Defense zones (areas immediately adjacent to houses) or to two KREW management areas that contain the PSW watershed study. In these areas, retention of key habitat groups and the maintenance of habitat functionality by implementing the PSW/Cedar Valley silvicultural

strategy would not be emphasized. Throughout the eight management units, existing canopy cover would be maintained at a minimum of approximately 60 percent in habitat classified as CWHR 5D. Existing canopy would be located by drawing polygons around homogenous areas of vegetation on 2001 aerial photos then classifying the vegetation into CWHR Type following the Cedar Valley strategy as a model. For 50 percent of the forested landscape, canopy cover would be maintained at a minimum of 60 percent where it currently exists, primarily in key habitat clumps. Overall, canopy cover would average 48 percent outside of WUIs, 49 percent in WUI Defense zones, 54 percent in WUI Threat zones and 54 percent in the DFPZs. See Table 2-8 for a comparison of canopy covers by alternative.

Alternative 4 uses the targets for tree retention from the Interim Pacific Fisher Habitat Maintenance and Improvement Approach paper (Smith and Sorini, 2008) as appropriate. This approach, recommended by PSW, emphasizes what is left in a treated stand, rather than what is removed and that the distribution of number of trees per acre by diameter class in mixed conifer forest subject to frequent low-intensity fire was highly variable but generally flat due to periodic episodes of fire induced mortality and subsequent recruitment (Stine and others, In Review).

**Figure 2-34. Comparison of Southern Sierra Fisher Conservation Area with Map of 85 Percent of all Fisher Detections**




The map of 85 percent of all fisher detections represents updated information from the 2008 Conservation Biology Institute (CBI) report and is proposed as the new boundary for the Fisher Conservation Area in Alternative 4.

**Fisher Conservation Area and Limited Operating Period Guidance**

The Southern Sierra Fisher Conservation Area (SSFCA) includes all or parts of the Bear_fen_6, El_o_win_1, Glen_meadow_1, Krew_prv_1 Providence_1, and Providence_4 Management Units. A limited operating period (LOP) would occur from March 15 through June 15 within the SSFCA. No mechanical treatments would occur during this period within the SSFCA. Mechanical treatments planned for North_Soaproot_2, Krew_bul_1 and Krew_prv_1 Management Units would be unaffected by this limited operating period.

Prescribed fire could occur during the limited operating period but initial site treatments would be limited to cooler prescriptions designed to retain at least 70 - 90 percent of the project's existing large logs, snags and hardwoods (those over 24 inches dbh). Subsequent underburns could be implemented and monitored during the limited operating period with routine prescriptions.

All known and currently occupied den sites would be protected with a 700 acre buffer regardless of whether they are inside or outside of the SSFCA boundaries. All den buffer areas would be subject to a limited operating period. Spring pile burning may occur within the den buffers during the limited operating period window. Prescribed underburning may also be permitted using prescriptions designed to retain at least 85 - 95 percent of the large logs, snags and hardwoods in those buffers.

Implementation monitoring of activities that occur between March 15 and June 15 would be coordinated with the Pacific Southwest Research Station and used to assess the effects of these activities on fishers and fisher habitat structure. Modifications in effective dates for the fisher limited operating period; types of permitted activities; and/or the extent of permitted activities could be made if undesired or unexpected impacts are observed.

Computer programs such as CONSUME and FOFEM can aid in determining fuel moisture parameters for large fuels needed to meet the above retention objectives.

**PSW and Cedar Valley Silvicultural Strategies**

The silviculture prescription for Alternative 4 is based on work done by PSW (Appendix I). The Cedar Valley Strategy is a separate but similar approach evolved from public recommendations for creating a more heterogeneous stand by emphasizing the reestablishment of ecological processes across the landscape (Appendix H). The Cedar Valley Strategy was further modified as a consequence of public comments on the Cedar Valley Project during a public field review conducted on June 8, 2007. Relevant aspects of the Cedar Valley Strategy have been incorporated into the formulation of Alternative 4. Both strategies emphasize retaining clumps of the highest quality habitat with high canopy covers and creating growing space in areas between clumps.

The Alternative 4 strategy maintains a higher level of canopy cover in highest quality Pacific fisher habitat (CWHR 5D) compared to Alternative 1. Alternative 4 provides heterogeneity across the landscape by retaining shrub/understory patches and higher

densities of 20-30 inches dbh trees when they are associated with clumps of larger trees (greater than 30 inches dbh). Average canopy cover of a stand should not drop below 50 percent (overall) in stands where it currently exists. Portions of the treated stands would be maintained at 60 percent or greater canopy cover (primarily in high quality Pacific fisher habitat).

Following are the specific modifications that comprise Alternative 4's silvicultural strategy:

- Canopy cover greater than 60 percent would be retained in habitat classified as CWHR 5D
- Canopy cover would be maximized in areas with high existing canopy cover and large trees that are favorable for fisher resting/denning
- A higher basal area would be retained compared to the balance of the stand in areas where large trees (greater than 30 inches dbh) are clumped with 20 to 29 inches trees
- Basal area would be approximately 80 percent of full stocking
- In these clumps of large trees, the basal area target would be increased to approximately 80 percent of full stocking which would be 240 $ft^2$/acre for mixed conifer and 210 $ft^2$/acre for ponderosa pine stands. The reader should note that the same acres are treated in alternative 3 and 4, although the clumps in Alternative 4 are unique to 4.

Heterogeneity would be increased across the landscape with a higher density of medium and large trees in some places. Mortality in large to medium sized trees in these clumps could produce valuable large snags and down woody material.

The approach for achieving desired clumpiness would include:

- Identify groups or patches of five or more large trees
- Determine if trees present in the group or patch were greater than 30 inches dbh
- Determine whether or not trees being retained in groups or patches had touching or nearly touching crowns, or could have by retaining additional trees
- Retaining additional trees to create groups or patches of large trees that had touching or nearly touching crowns if necessary
- Use the basal area target to determine whether or not to harvest trees with marginal value for increasing crown closure and/or forest health, or trees on the edge of a group or patch

Some patches of understory shrub, hardwoods and small trees would be retained across the landscape with a rough target of 10 to 15 percent of the area to be treated. This prescription is intended to provide understory cover and habitat for fisher and its prey in small discontinuous patches (to maintain the desired reduction in wildfire risk). Riparian areas and steep slopes within the area to be harvested may already contribute sufficient amounts of this type of habitat. A balance is necessary because retention of too much shrub habitat can pose an increased fire risk.

**Alternative 5 - Thin from Below**

Alternative 5 is similar to Alternative 3, except the maximum allowable limit for thinning treatments would be 20 inches dbh. The intent is to make Alternative 5 compatible with the 2001 version of the Sierra Nevada Forest Plan Amendment. Updated information to better protect Pacific fisher and California spotted owls would be used. The most important update reflects new science that suggests that fuels reduction is necessary in close proximity to habitat for fire protection to be effective. As a result, dbh and fuels treatment limitations for the Southern Sierra Fisher Conservation Area that were part of the original 2001 decision were determined to be obsolete, and were not carried forward into this alternative. The KREW Study, CSOS and monitoring projects would continue unchanged from Alternative 3. Continuation of these studies is compatible with the 2001 SNFPA. Alternative 5 is a reevaluation of an alternative previously considered but eliminated from detail study in the 2006 FEIS.

**Summary of Treatments by Alternative**

**Table 2-4. Summary of Treatments by Action Alternatives**

| **Commercial Thinning Acres** | | | | |
|---|---|---|---|---|
| **Treatments** | **Alternative 1** | **Alternative 3** | **Alternative 4** | **Alternative 5** |
| **Diameter Limit** | 35 inches | 30 inches | 30 inches | 20 inches |
| **Tractor** | 4793 acres | 4793 acres | 4793 acres | 4793 acres |
| **Helicopter** | 1247 acres | 1247 acres | 1247 acres | 1247 acres |
| **Non-Commercial Thinning Acres** | | | | |
| **Treatments** | **Alternative 1** | **Alternative 3** | **Alternative 4** | **Alternative 5** |
| **Hand Removal** | 726 acres | 726 acres | 726 acres | 726 acres |
| **Machine Removal** | 1320 acres | 1320 acres | 1320 acres | 1320 acres |
| **No Treatment** | 5647 acres | 5647 acres | 5647 acres | 5647 acres |
| **Other Fuels Reduction Treatments** | | | | |
| **Treatments** | **Alternative 1** | **Alternative 3** | **Alternative 4** | **Alternative 5** |
| **Hand Pile** | 420 acres | 420 acres | 420 acres | 420 acres |
| **Tractor Pile** | 2968 acres | 2968 acres | 2968 acres | 2968 acres |
| **Grapple Pile** | 1011 acres | 1011 acres | 1011 acres | 1011 acres |
| **Crush** | 136 acres | 136 acres | 136 acres | 136 acres |
| **Lop & Scatter** | 3147 acres | 3147 acres | 3147 acres | 3147 acres |
| **Masticate** | 1031 acres | 1031 acres | 1031 acres | 1031 acres |
| **Whole Tree Yard** | 316 acres | 316 acres | 316 acres | 316 acres |
| **No Treatment** | 4724 acres | 4724 acres | 4724 acres | 4724 acres |
| **Prescribed Fire Treatments** | | | | |
| **Treatments** | **Alternative 1** | **Alternative 3** | **Alternative 4** | **Alternative 5** |
| **Under burn** | 4685 acres | 4685 acres | 4685 acres | 4685 acres |
| **Broadcast burn** | 146 acres | 146 acres | 146 acres | 146 acres |

| | | | | |
|---|---|---|---|---|
| **Pile Burn** | 4399 acres | 4399 acres | 4399 acres | 4399 acres |
| **Jackpot Burn** | 139 acres | 139 acres | 139 acres | 139 acres |
| **No Burn** | 4386 acres | 4386 acres | 4386 acres | 4386 acres |
| **Site Preparation & Planting** | | | | |
| **Treatments** | **Alternative 1** | **Alternative 3** | **Alternative 4** | **Alternative 5** |
| **Prep, all types** | 808 acres | 717 acres | 717 acres | 717 acres |
| **No Site Prep** | 12946 acres | 13037 acres | 13037 acres | 13037 acres |
| **Reforest Grps Plant** | 581 acres | 490 acres | 490 acres | 490 acres |
| **Plantations** | 199 acres | 199 acres | 199 acres | 199 acres |
| **Natural Regeneration** | 32 acres | 27 acres | 27 acres | 27 acres |
| **Release Treatments** | | | | |
| **Treatments** | **Alternative 1** | **Alternative 3** | **Alternative 4** | **Alternative 5** |
| **All Hand** | 1057 acres | 1057 acres | 1057 acres | 1057 acres |
| **Mechanical** | 479 acres | 479 acres | 479 acres | 479 acres |
| **Herbicides** | 947 acres | 856 acres | 856 acres | 856 acres |
| **Noxious Weed Control** | | | | |
| **Treatments** | **Alternative 1** | **Alternative 3** | **Alternative 4** | **Alternative 5** |
| **Herbicides** | 29 acres | 29 acres | 29 acres | 29 acres |
| **Hand Pull** | 4 acres | 4 acres | 4 acres | 4 acres |
| **Road Summary** | | | | |
| **Treatments** | **Alternative 1** | **Alternative 3** | **Alternative 4** | **Alternative 5** |
| **Reconstruction** | 84 miles | 84 miles | 84 miles | 84 miles |
| **New*** | 2 miles | 2 miles | 2 miles | 2 miles |

* New roads do not include temporary roads, skid trails or landings. Temporary road locations and erosion control measures are determined during project implementation by the Sale Administrator through agreement with the purchaser (BMP 2.26). Potential impacts are evaluated as part of the overall treatment system. Efficacy of this BMP is evaluated annually and reported every 5 years.

**Design Features Common to Each Action Alternative**

General project design measures incorporated into each action alternative are listed below. Design measures may be refined using site-specific information during implementation.

**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. 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 (PM10) in 1992.

Specific techniques to reduce fire emissions include:

1) Commonly used reduction techniques - burning units after harvest before new live fuels appear; burning in the springtime prior to "green-up"; burning when 1,000 hour fuels (woody debris larger than 3 inches in diameter) moistures are high; and burning when the duff is wet (after fall precipitation, or during winter and spring)
2) Avoidance techniques - burning on cloudy days when the plume and residual smoke cannot be seen; burning during periods of atmospheric instability for better smoke dispersal; and burning during periods of low visitor use
3) Techniques to optimize flaming combustion - burning piled fuels rather than broadcast burning; reducing the amount of soil 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 de minimis emissions. (For full determination refer to the Kings River Project Air Determination, available in the project record.)

**Aquatic Species**

Some 2004 Sierra Nevada aquatic species design measures were not incorporated into each management unit because of conflicts with research study objectives intended to evaluate the basis for those measures. The primary objective in Krew_bul_1 and Krew_prv_1 Management Units is the KREW study.

A unique population of Yosemite toads occurs within the Krew_bul_1 Management Unit. An interdisciplinary review of design measures identified a conflict with the LOP for Yosemite Toad that would normally be used in this circumstance. Limitations on operations within 0.6 miles of occupied meadows would restrict activities on a large portion of the Krew_bul_1 Management Unit. Protection measures in the 0.6 mile LOP were modified for operations in the Krew_bul_1 unit because of conflicts with research study objectives (Hunsaker 2004; Hopson and Strand 2004. The 500 foot buffer of occupied meadows prohibiting mechanical treatments was replaced with a 100-foot no mechanical treatment zone. Protection measures identified for the Yosemite toad would apply for Alternative 1, 3, 4 and 5, including the revised limited operating period within 0.6 miles of occupied meadows, (technical assistance by the U.S. Fish and Wildlife Service in 2006).

Some of the original protection measures for Relictual slender salamanders were also rejected based on KREW study objectives (Hunsaker 2004; Hopson and Strand 2004). This change within the Krew_bul_1 Management Unit is identical for Alternatives 1, 3, 4 and 5.

Protection measures identified for the Yosemite toad would apply for Alternative 1, 3, 4 and 5, including the limited operating period within 0.6 miles of occupied meadows,

(technical assistance was provided by the U.S. Fish and Wildlife Service (USFWS) (Appendix D).

Some original protection measures were modified for the California red-legged frog in Providence_4 and Providence_1 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).

Any seeps, springs, bogs, fens, and/or wet areas found during project implementation that have not already identified on project analysis maps would be protected. These areas would be treated as perennial areas with a 300-foot RCA.

Specific protection measures would be applied for the California red-legged frog (CRLF; Federally Threatened Species) suitable habitat identified within the N_soaproot_2, Providence_1, Providence_4, and Bear_fen_6 Management Units. These measures include:

1) No mechanical treatments year-round within 300 feet of identified CRLF suitable habitat except within Providence_1 and Providence_4 Management Units where helicopter yarding or endlining from roads would be used (treatment around the Blue Canyon Work center and campgrounds would be allowed where the WUI and the CRLF 300-foot buffer coincide)
2) Only water would be used for dust abatement within 300 feet of identified CRLF suitable habitat
3) No water drafting sites would be located within 300 feet of identified CRLF suitable habitat
4) A limited operating period would be implemented from October 1st to June 15th in which no project related activity could occur within 300 feet of identified CRLF suitable habitat

Protection measures for the species and habitat of Western pond turtle (Forest Service Sensitive Species) and Relictual slender salamander (Forest Service Sensitive Species) include:

- No piling or burning of piles within RCA (not applicable to stands within Krew_prv_1 and Krew_bul_1 Management Units, see Table 2-6 for RCA specifications)
- No ignition of fires within RCA although fires would be allowed to creep into RCA (not applicable to stands within Krew_prv_1 and Krew_bul_1 Management Units)
- Avoid removal of riparian vegetation within RCA
- No storage of petroleum products within RCA
- Use only water for dust abatement within RCA
- No mechanical treatments within RCA during the wet season (October 1 to June 15) in N_soaproot_2, Providence_1, Providence_4 and Krew_prv_1

Conservation measures for the Yosemite toad resulting from technical assistance by the U.S. Fish and Wildlife Service in 2006:

- No treatments of herbicides/pesticides within 500 feet of the occupied meadows

- No water drafting sites located within 0.6 miles of the occupied meadow
- Trees may be felled within 100 feet of meadows and removed by means of a cable
- Only trees 50 or more feet away would be felled in meadows used as breeding habitat,
- Operations would start after breeding is over and end by October 1
- Operations would cease for 24 hours after rainfall greater than 0.1 inch within 0.6 miles of occupied meadows
- Meadow occupancy and timing of breeding would be determined annually by a qualified specialist
- Heavy machinery would 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
- Do not allow mechanical equipment within 100 feet of meadows or other special aquatic features

General aquatic species and riparian habitat design measures within all RCAs include:

- Maintain channel bank stability by not cutting streambank trees (trees with drip line extending to or over the edge of the streambank
- A screened intake device and pumps would be used for water drafting, with low entry velocity to minimize the removal of aquatic species from their habitat. See Best Management Practices (BMP) 2-21 in Appendix D for specific requirements.
- Potential project effects to streams and aquatic habitat would be monitored using Region 5 (R5) Stream-Condition Inventory protocols (Frazier and others 2005). Any discovery of amphibians or reptiles (e.g. frogs, toads, salamanders, and turtles) during project sale preparation and implementation would be reported to the District Fisheries / Aquatic Biologist.
- Slash piles would be ignited from one end only to allow wildlife to escape.

Additional species protection measures may be needed if unknown occurrences of federally listed threatened, endangered, proposed, candidate or Forest Service sensitive aquatic species are found within the project area.

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

**Table 2-5. Riparian Conservation Area (RCA) Widths and 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 |

Management directions for each aquatic area apply to each action alternative. Exceptions occur only in Krew_bul_1 and Krew_prv_1 study watersheds as noted.
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); 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 (Appendix D), and other applicable laws and regulations (USDA 2000b) would be followed. Riparian Conservation Areas (RCA) are defined in Table 2-6 above.

**Botanical Resources**

The following project design measures are for protection of Threatened, Endangered, and Sensitive (TES) plant species.

- Identify, flag, and avoid areas of known TES plant occurrences prior to implementation of mechanical and chemical treatments
- Do not fell trees or drive equipment or vehicles on rock outcrops or on thin, sandy or gravelly soils identified by Forest Service botanists as suitable habitat for TES plants
- Consult with a Forest Service botanist before cutting hand line through shallow, gravelly soils to avoid inadvertent damage to undiscovered TES plants (TES plants of this habitat type can populations can cover greater areas in good rain years or be invisible in poor rain years)
- Consult with a Forest Service botanist prior to using herbicides on shallow soils below 3800 feet in elevation
- Consult with a botanist before hand thinning of shrubs on rock outcrops or associated gravelly soils between mid-February and July

- Do not build temporary roads through areas of thin, gravelly soils until plant surveys of the proposed routes are complete
- Ensure that heavy equipment operators recognize and avoid *Carpenteria californica* during mastication and tractor piling for work performed in management unit N_soaproot_2 and Providence_4
- Instruct crews doing hand thinning and hand piling to recognize and avoid damaging *Carpenteria californica*
- Surveys would be conducted to identify sensitive plants for prescribed fire treatments below 4500 feet. Populations would be monitored before and after fire to determine effects

**Noxious Weeds**

Follow noxious weed management goals identified in Forest Service Manual (FSM) 2081.2, including:

- Prevent the introduction of new invaders
- Conduct early treatment of new infestations
- Contain and control established infestations
- Clean all equipment of soil and plant parts before bringing onto the National Forest or beginning work in a new management unit to reduce the potential spread of noxious weeds
- Survey disturbed areas for noxious weeds for two years after vegetation treatments occur in a unit
- Promptly remove any weeds found to stop seed set
- Continue treatment for as long as necessary to eradicate any occurrences
- Coordinate with botanist prior to layout of final road locations
- Treat known noxious weed sites as described in unit descriptions before treating these areas or beginning road construction or reconstruction

**Herbicide Use**

Design measures would be applied when herbicides are used in reforestation groups, plantations or noxious weed eradication. Design measures include:

- Glyphosate would not be applied within Streamside Management Zones (SMZs) of flowing streams to protect water quality
- Glyphosate may be applied by hand within five feet of dry stream channels
- 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

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 may be protected from treatment through consultation with local Native Americans.

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. All applicable pesticide laws and label restrictions would be followed to ensure human health and safety (BMP 5.8 and 5.11). The application of glyphosate would be stopped when wind speed exceeds five miles per hour or as soon as drift is visually observed (BMP 5.13) to avoid affecting non-target plants and aquatic habitats. Signs would be installed at all areas treated with glyphosate, warning that herbicide had been applied and that products should not be gathered for food or medicine for 30 days to help assure no effects occur to human health and safety.

**Heritage Resources**

Project implementation would 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)., of Undertakings Where Management Measures Are Necessary for the Protection of Historic Properties.

Specific design features common to all alternatives for Heritage Resorces are:

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 would be excluded from proposed project 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 would 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.

c. Protect 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 would 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.

d. The Sierra National Forest would comply with the stipulations of the Regional PA (V.) in the event of inadvertent effects or new discovery during implementation.

**Roads**

New or replacement culverts would be designed to accommodate the 100 year storm. Best Management Practices would be designed and implemented to address hydrologic and aquatic species concerns. BMPs would be maintained to ensure their effectiveness consistent with operational requirements and contract specifications.

Dust abatement would occur as a preventative measure during project activities with the objective of promoting safe use of roads, preventing loss of road , preventing fugitive dust would be prevented; and protecting adjacent resources would be protected. Water or other dust palliatives would be used to accomplish dust abatement. Design measures identified in the Aquatic Resources section above would be adhered to.

Legal access would be acquired before using any road through private lands. Engineering would provide site-specific recommendations for reconstruction or extraordinary maintenance.

**Vegetation**

Five to 35 percent of growing space would be maintained to provide oak trees for wildlife. Decadent oaks would be maintained everywhere and would not be removed. Over topping of decadent oaks by conifers would be allowed to continue.

Reforestation stocking would meet standards described in the LRMP. The release of existing plantations should meet growth and stocking standards outlined in growth and yield tables (Oliver and Powers 1978). Thinning in plantations would be limited to periods when slash would be less likely to provide Ips species habitat (December to June) to reduce the potential from insect attacks.

**Soils**

Protection of soils below large rock outcrops – Mechanical treatments should leave a 100-foot wide buffer of 100 percent soil cover below large rock outcrops would remain. These areas have a high potential to generate runoff that can cause accelerated erosion on soils down slope. Prescribed burning would employ firing patterns to maximize cover in these areas.

Tractor-piling operations - Tractor piling would be conducted when soil is sufficiently dry in the top 12 inches to prevent unacceptable loss of soil porosity (compaction). Field checking would be done to determine if operations could continue under wet soil conditions. Maintain at least 90 percent of the natural soil porosity over 85 percent of an activity area. Tractor piling would be limited to slopes less than 35 percent.

Protection of roads – Subsoiland waterbar roads and trails would be subsoiled in areas where soils have a high compaction hazard. This is especially important in areas where Holland family soils occur.

Treatment Areas – Well distributed soil cover of 50 percent would be maintained over treatment areas. Crushing before piling would be attempted where shrub species predominate to create small woody fragments left scattered over the site for soil cover and erosion protection.

Fuel Treatments – Grappler piling or another light-on-the-land mechanical fuel treatment method would be utilized for Alternatives 1, 3, 4 and 5

**Watershed Design Considerations**

Aggregate surfacing - Aggregate surfacing of National Forest System Roads (NFSR) would be prioritized on sensitive soils (soil map units 136, 137, 138, 139, & 140) for sub-watersheds that exceed the Threshold of Concern (TOC).

Watershed - Best Management Practices are common to all action alternatives. Specific measures are identified in Appendix D. Best Management Practices would be included in project contract specifications and maps and installed during project implementation. These measures are required to meet State of California water quality standards.

Ground disturbing impacts (i.e., soil compaction, vegetation disturbance, etc.) – Ground disturbing impacts would be reduced as much as possible within riparian conservation areas (RCA) and critical aquatic refuges (CAR). Forest Service specialists including a botanist, soil scientist, and/or hydrologist would be consulted to determine follow-up

treatments if BMP prescriptions fail to work as planned within a reasonable time. Temporary roads within the SMZ would be removed and revegetated wherever feasible.

Hazardous material - Oils and fuels storage, and refueling sites would be located outside of RCA and CAR except as specifically approved by the District Ranger.

Logging operations on tractor ground (slopes less than 35 percent) – Logging operations on tractor ground would use light-on-the-land logging systems such as Cut-to-length (CTL) or Whole Tree Yarding systems in sub-watersheds that are over the upper threshold of concern (TOC) for cumulative watershed effects. CTL logging systems are the preferred light-on-the land logging system, if available. Utilize grapple piling in areas proposed for tractor piling in sub-watersheds that are over the upper TOC for cumulative watershed effects when feasible.

Streamside Management Zones (SMZ) – SMZs are managed primarily to protect and maintain water quality, site productivity, channel stability, wildlife habitat, and riparian vegetation. 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.

Watershed objectives are based on five critical elements relative to streamside management zones or Riparian Conservation Areas:

- Retention of large woody debris
- Maintenance of ground cover including litter fall for nutrient recycling
- Maintenance of root strength on stream banks
- Creation or maintenance of shade canopy over water courses
- Maintenance of microclimate (soil moisture, radiation, soil temperature, air temperature, wind speed, and relative humidity)

Vegetation within the SMZs of Class I or II streams would not be treated in sub-watersheds over the lower threshold of concern (TOC). Treatments for Class I and Class II SMZ that are not located within sub-watersheds exceeding the lower TOC and not located within Old Forest Linkage would have a minimum of 280 square feet of basal area retained. These areas would feature mature and decadent stand characteristics within rest sites identified as likely fisher habitat.

Treatments for these areas include:

- Avoid the creation of openings by limiting thinning to a maximum of 30 percent of the existing basal area
- At least 60 percent Canopy cover is desired in fisher use areas
- Canopy cover should not go below 50 percent

- Establish monitoring points within treatment areas to evaluate the effectiveness of the SMZ as riparian habitat and as an allocation designed to maintain or achieve State water quality standards
- Do not allow mechanical equipment within streamside management zones (SMZ)
- Reconstruct roads at selected locations in order to reduce the length of road that is hydrologically connected to the stream network

Prescribed Fire in Streamside Management Zones – Design prescribed fires within the SMZ by backing prescribed fires into the SMZ. Avoid direct ignition of fuels within the SMZ, except in the KREW Study areas. Within the KREW Study Management Units avoid direct ignition of fuels within 5 feet of the stream channel or within riparian vegetation.

Project roads would be treated to meet to current BMP requirements as follows:

- Any new roads, that cross or are within a SMZ for a Class I (perennial) or II (intermittent) stream, should be reviewed by an aquatic or watershed specialist.
- Temporary roads within SMZs would be restored to near original hydrologic conditions.
- Road surfaces and stream crossings would be hardened where necessary to meet water quality standards
- Road drainage would be disconnected from streams
- Appropriate seasonal closures would be implemented to maintain water quality

Delivery of sediment to streams may be avoided by using one or more of the following techniques:

- Outsloping of road surfaces to quickly direct runoff from the road surface rather than concentrating flows in an inboard ditch and routing flows to the stream channel
- Installing rolling dips and /or additional relief culverts to minimize the length of road draining into stream channels
- Armoring drainage outlets to minimize the risk of fillslope erosion
- Rocking ditches to reduce flow velocity in the ditch, prevent ditch erosion, and encourage deposition, where other techniques are not feasible
- Armoring road surface approaches on segments that cross streams

These design measures pertain to all roads that may affect water quality. Implementation of some of these non-critical features may be dependent on available funds. A prioritized list of work would be included in the project's KV plan. Non-critical BMP work would be prioritized within eight sub-watersheds where cumulative watershed effects are a concern. Non-critical work may include improvements to existing water quality or restoration, where beneficial uses are not impaired.

Critical BMP work includes all road mitigations necessary to meet water quality standards immediately. Site-specific design features based on these BMPs would be incorporated into road reconstruction or construction packages (contracts).

**Wildlife**

Fisher - The long-term goal for developing and/or maintaining potential fisher habitat is to have 50 percent of the landscape in CWHR size Class 4 or higher with 50 percent canopy cover or greater. Historically, the capability of land to grow and maintain canopy cover varies site by site depending on soil productivity, potential natural vegetation, available moisture, and the aspect. The ponderosa pine type is not capable of canopy covers greater than 60 percent. The mixed conifer type is more likely to have canopy cover greater than 60 percent on north and east aspects because they are cooler and wetter than south and west aspects. The true fir type usually has canopy cover greater than 60 percent on all aspects.

Design measures (common to all alternatives) for the Southern Sierra Fisher Conservation Area include:

- Protecting important habitat structures such as large diameter snags and oaks
- Protecting patches of dense large trees typically ¼ to 2 acres
- Protect large trees with cavities for nesting
- Fire lines would be placed around snags and large logs or other prescribed fire techniques would be used to minimize effects on these structural features.
- Protect all known fisher den sites with an Limited Operating Period, from March 15 through June 15th

Other prescribed fire techniques would be implemented to minimize effects. Refer to Table 2-6 for additional measures. These habitat structural design measures would apply to all action alternatives, and all management units.

**Table 2-6. Protection Measures for Fisher and Habitat**

| Needs | Measures |
|---|---|
| Balancing community protection treatments with long-term management of high-quality fisher habitat | Develop fuels treatment and restoration strategies for the project's management units that provide for the protection of communities in concert with meeting the long-term goal of developing and/or maintaining 50 percent of the overall potential fisher habitat in CWHR size Class 4 or higher with 50 percent 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. |
| Timing of treatments | Single acres of fisher habitat are likely to be disturbed several times during the course of reaching a resilient stand. Areas would be thinned, possibly be masticated in some areas or burned. Applying these treatments in as short a time as possible to minimize the period of disturbance is desirable. Timing of successive treatments would be evaluated as a component of the adaptive management studies and modified as necessary. See next. |
| 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 eight management units. We would monitor 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. |

Conservation measures for fisher that would be adopted from technical assistance by the U.S. Fish and Wildlife Service in 2006:

- Increasing retention of stands with greater than 60 percent 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 under burning
- Use the *Fisher and Priority Sites Marking Guide – Kings River Project* to identify the most suitable individual trees and groups of trees for retention
- Retain all oaks unless they are a hazard to operations
- Create a system of Old Forest Linkages (OFL) along perennial streams, including 300 feet of adjacent habitat with 50 to 60 percent canopy cover on each side of stream
- Monitor high quality fisher habitat in two or more of the eight project management units and untreated controls (all action alternatives)

California Spotted Owl Study (common to all action alternatives) - Treatments are proposed within California spotted owl Protected Activity Centers (PAC) except no. 21,

27 and 147 as part of the California spotted owl study (CSOS). Treatments in PACs are based on management direction for the defense zone of the WUI included in the 2001 Sierra Nevada Forest Plan Amendment Record of Decision (SNFPA ROD). The 2001 SNFPA ROD prescribes thinning from below and design measures that restrict mechanical treatments within 500 feet of spotted owl activity centers (50 acres surrounding a nest). Trees less than 6 inches dbh would be hand cut within activity centers. Thinning would occur for trees less than 20 inches dbh outside activity centers but within PACs (300 acres of best habitat that includes a nest site).

Under SNFPA ROD (2001) hand thinning limits increase slightly to a 10 inch dbh limit when a plantation occurs within a PAC's activity center. Tree removal would retain 50 percent canopy cover across the vegetated stand in all cases. Only trees less than 6 inches dbh would be thinned when pre-treatment canopy cover is between 40 to 50 percent. The absolute limit of canopy reduction would be 20 percent of existing canopy cover in every circumstance. Mechanical treatments would be limited to 75 percent of the applicable stand in a PAC. The purpose of these treatments is to improve the sustainability of PACs and improve the chances of owl survival when wildfires occur.

Under SNFPA ROD (2001) stand-altering activities in PACs located outside threat zones would be limited to reducing surface and ladder fuels through prescribed fire treatments. Prescribed fire
treatments in forested stands with overstory trees 11 inches dbh and greater would be designed to have an average flame length of 4 feet or less. Hand treatments including handline construction, tree pruning, and cutting small trees (less than 6 inches dbh) would be conducted within a 1-2 acre area surrounding known nest trees as needed.

In PACs 21, 27 and 147, the Standards and Guidelines from the SNFPA FSEIS ROD (2004) apply except in the krew_bul_1 and krew_prv_1 Management Units the limited operating period (LOP), prohibiting vegetation treatments within approximately ¼ mile of the activity center during the breeding season (March 1 through August 31) does not apply.

Goshawks - Protected activity centers (PAC) of 200 acres would be established for known and discovered northern goshawks to protect breeding adults and their offspring under the Sierra Nevada Forest Land Management Plan Amendment. Northern goshawk PACs would be designated based upon latest documented nest sites and locations of alternate nests. PACs may be designated based on the location of territorial adult birds or recently fledged juvenile goshawks if actual nest sites are not located.

A limited operating period (LOP) would be maintained prohibiting vegetation treatments within approximately ¼ mile of nest sites during the breeding season (February 15 through September 15) unless surveys confirm that northern goshawks are not nesting. Krew_bul_1 and Krew_prv_1 Management Units, and PACs involved in the CSOS Study would not be included. A LOP may be applied to a ¼ mile area surrounding PACs if nest stands within a protected activity center (PAC) are unknown. Surveys may determine nest stand locations (USDA 2004a, p.60).

Great grey owls - Surveys are currently being conducted for great gray owls. A limited operating period that prohibits vegetation treatments and road construction within ¼ mile of any active great gray owl nest stand during the nesting period (typically March 1 to August 15) would be needed. Krew_bul_1 and Krew_prv_1 Management Units, and PACs involved in the CSOS Study would not be included. LOPs 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. LOP buffer distances may be reduced where a biological evaluation concludes that nest sites would be shielded from planned activities by topographic features that would minimize disturbance.

Nevada red fox, marten and wolverine - Conservation strategies for Sierra Nevada red fox, marten and wolverine conservation contain three critical elements: recover and protect populations; minimize fragmentation; and protect den sites. A specified area would be delineated to protect all known nesting, roosting, and denning sites. Marten den sites would have 100 acres of the highest quality habitat surrounding den sites arranged in as compact a unit as possible. An analysis would be conducted upon detection of a wolverine or Sierra Nevada red fox, to determine if activities within five miles of the detection may have a potential to affect the species. Detection could be by photograph; track plate; or sighting verified by a wildlife biologist. Activities would be restricted for a 2-year period following any detection if they are determined to have an adverse impact.

**Adaptive Studies and Experimental Treatments on Kings River Experimental Watershed (KREW)**

The Kings River Project was established in 2002 with an inter-agency Memorandum of Understanding (MOU) signed by both the Station Director (PSW) and Regional Forester (Forest Service). This MOU agreed to establish project size at approximately 132,000 acres. The two KREW units in this study are a subset of this larger area at 3,093 acres.

The Sierra National Forest treated four management units (5,500 acres in Reese, 10S18, I-Rock, and South of Shaver) in the project area about 10 years ago using a combination of uneven-aged management and thinning from below. Prescribed fire has additionally been applied across approximately 17,300 acres. Approximately 5,000 of these acres have had follow-up treatment using prescribed fire.

Progress through 1998 including lessons learned is documented in the general technical report PSW-GTR-183 (*Proceedings of a Symposium on the Kings River Sustainable Forest Ecosystems Project: Progress and Current Status*, 1998). Published research projects are also documented.

The KREW Study would address multiple scientific objectives and study various aspects of the actions required to create a more resilient forest including the effects of prescribed fire. The KREW Study would assist the Forest Service in determining the feasibility of managing a sustainable forest ecosystem in the southern Sierra Nevada, for multiple resource concerns and demands. Improving forest resiliency has a high potential for long-

term benefits to the California spotted owl and other wildlife species; improving forest health; and developing a sustainable level of productivity.

The proposed eight projects have undergone significant adaptions compared to the treatments in the first four management units. A major new research objective has been added to examine fisher habitat requirements and to better understand how fisher might respond to various kinds of vegetation management treatments. The KREW project currently has collected five years of pretreatment data and is waiting for prescribed treatments to be put in place. Owl demographic data continues to be collected. Study data in combination with demographic data collected in other locations of the Sierra has been instrumental in informing two decisions by the Fish and Wildlife Service. Those decisions considered listing the California spotted owl as endangered. A silviculture research component has been proposed as ana addition to this array of research activities, directed by Dr. Kevin O'Hara from U.C. Berkeley. Extensive information and the research study plans are availble on The Sierra Nevada Research Center website: www.fs.fed.us/psw/programs/snrc.

**Table 2-7. Current, Past and Proposed Studies in the Kings River Project**

| Study Name | Principal Investigator | Purpose |
|---|---|---|
| Kings River Experimental Watershed (KREW) | Carolyn Hunsaker | Effects on watershed condition from vegetation treatments including prescribed burning |
| Fisher Response to Fuel Treatments | Kathryn Purcell | Examination of fisher habitat selection, limiting factors, and effects of fire and fuels treatments |
| Fisher Status and Trend | Rick Truex | Monitor population trends |
| Silviculture (proposed) | Kevin O'Hara (UCB) | Evaluate how the silvicultural prescription applied to Kings River meets the overall goal of forest resiliency |
| CSOS | John Keane | California Spotted Owl Demographic Study, Underway since 1990 - the long-term objective is to determine whether landscape treatments in the Kings River Project create habitat in which owls can maintain a self-sustaining population. See management description in following section. |
| Song Bird Study (completed) | Kathryn Purcell | To learn whether individual species of breeding birds shift up and down in elevation in response to the severity of the previous winter's weather, and to determine whether their breeding success is related to specific habitat attributes and changes in habitat |
| Long-term Soil Productivity Studies | PSW-Redding | Effects of timber harvesting practices on soil productivity |

Additional studies on the Sierra National Forest include the Sierra Nevada Adaptive Management Project (SNAMP) and the Teakettle Experimental Forest research.

Ongoing PSW Fresno research questions - How would wildlife species respond to changes in vegetation structure and spatial distribution resulting from the proposed forest management activities? Currently, the primary work addresses California spotted owls and fishers. Past work included forest bird communities.

How do physical, chemical, and biological characteristics of headwater stream ecosystems and their associated watersheds vary, both with and without management treatments?

How do combinations of mechanical and prescribed fire treatments affect stream ecosystems and watersheds?

Additionally, the project would contribute to the Adaptive Management Strategy of the SNFPA SEIS. The project would implement management activities (i.e., uneven-aged systems and prescribed fire). Research would study the effects of these activities.

**Exceptions to SNFPA ROD (2004) Standards and Guidelines used in the KREW Management Units and the California Spotted Owl Study**

Limited operating periods for California spotted owl and fisher would not be used for either study. Limited operating periods were determined to be incompatible with KREW or CSOS study designs. KREW studies require activities to take place in as few years as possible to concentrate effects and maximize the ecosystem's response. Employing LOPs would extend the time needed to implement projects, which would potentially mask any effects these studies were designed to measure. As a result, limited operating periods would not be applied in Krew_bul_1 and Krew_prv_1 Management Units. These changes would require a project specific plan amendment before they may take effect.

**Alternatives Considered but Eliminated from Detailed Study**

The National Environmental Policy Act (NEPA) requires Federal agencies to rigorously explore and objectively evaluate all reasonable alternatives. Reasons for eliminating any alternatives not developed in detail need to briefly be discussed (40 CFR 1502.14). Public comments received in response to the proposed action provided suggestions for alternative methods to achieve the purpose and need for the Kings River Project. Some of these alternatives may have been outside the scope of the project; duplicated alternatives considered in detail; or caused unnecessary environmental harm. A number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

**Alternative 6: Eliminate Herbicide Use**

The proposed action would be implemented without the use of herbicides. This alternative addresses concerns that the use of herbicides/surfactant would create an adverse risk of harmful effects to people and wildlife. A response from Californians for

Alternatives to Toxics applauded our effort to reduce hazardous fuel levels and to restore the historic forest conditions, but expressed concern with the use of herbicides.
This alternative was considered but eliminated from further study. This alternative does not meet the need of this project to control weeds. Noxious weeds need to be controlled throughout the project area. Competing vegetation in reforestation groups and plantations also needs to be controlled. Site-specific analysis found noxious weeds and intensive vegetative competition within the project area requires the use of herbicide to meet stocking levels and desired species composition.

A need to control competing vegetation exists where reforestation groups would be located. Competing vegetation includes bear clover (*Chamaebatia foliolosa*), manzanita (*Arctostaphylos spp*.), and deerbrush (*Ceanothus spp*). These brush species are very competitive with conifer seedlings for soil moisture and nutrients. 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 percent crown closure around conifer seedlings for a period of two to three 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). A high probability of reforestation failure or severely reduced growth exists without vegetation control. One study showed ponderosa pine growing in the middle of deer brush and manzanita. Area ponderosa pine had diameters and height growth of 60 to 90 percent when compared to trees without competing brush species (Oliver 1979, McDonald and Oliver 1984). The influence of competing vegetation was strongest at wider tree spacing. Another study found conifers are at a disadvantage in capturing adequate resources and establishing dominance without release from deer brush. McDonald and Fiddler (1989) noted without controlling vegetation growth 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). Planted tree productivity in the Sierra Nevada averaged more than three times higher in the absence of understory vegetation where summer drought is common (Powers and others 2004).

Multiple herbicide treatments are essential for conifer survival 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. Manual and mechanical methods 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 only 13 percent of planted conifers were alive after three years, 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 trees planted in an area with no vegetation control survived. Growth of surviving seedlings was also impacted. The same study found 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. They concluded that the exclusive use of manual or mechanical treatment does not meet the objectives of reforesting land that is suitable and capable of growing conifers and black oak. Manual or mechanical treatment does not control sprouting brush or 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. In this case, noxious weeds could alter the ecological balance affecting the desired species composition, the growth and health of large trees, and the effectiveness of fuels treatments.

**Alternative 7: Study Previously Harvested Areas**

Harvested areas would be studied without harvesting more timber in this alternative. 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 project area should not undergo commercial harvest in the name of science", and that "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 historic pre-1850 forest conditions, nor does not meet the purpose and need to gain knowledge about uneven-aged silvicultural strategy
- The amount of large trees would not increase
- Tree density would not be reduced
- No protection would be afforded to adjacent landowners
- Fuel loading or risks of fire would not be reduced

**Alternative 8: Sierra Nevada Forest Plan Amendment (2001)**

Forest treatments compatible with the Sierra Nevada Forest Plan Amendment (2001) was considered as an alternative in the 2007 Final EIS for the Kings River Project, but was dropped from further consideration because limitations on fisher habitat manipulation necessary to reduce fire risk did not allow achievement of the project's purpose and need. We have reconsidered this decision and have created Alternative 5 which presents the

same strategy as the 2001 SNFPA, updated to reflect new information. Specifically Alternative 5 differs from the original alternative considered but eliminated from detailed consideration by the following:

1. Fuels treatment in the fisher conservation area is only constrained by the 20-inch dbh limit that is this alternative's mainstay. Removing trees with diameters less than or equal to 10 inches (as originally proposed) is unlikely to reduce the threat of wildfire sufficiently to protect the habitat. Direct treatment of fuels inside and outside of fisher habitat is necessary to preserve that habitat in the long-term (CBI, 2008).
2. All of the treatments proposed for the research and monitoring studies would go forward as designed. The Forest Land and Resource Management Plan would be amended to allow this change to occur for these specific projects.

This alternative would not have been carried forward without these changes to the basic premise of the 2001 decision because the 2001 limitations on fuels manipulation would have been inconsistent with the best science currently available.

**Alternative 9: Reduced Intensity Harvest and Fuels Treatment**

A reduced intensity treatment alternative was considered. Treatments limited to thinning smaller diameter classes of 11 inches or less, also termed 'low thinning' or 'thinning from below', was considered. Concerns were centered on the assertion that planned treatments had a single aim, to reduce fire risk. Multiple goals associated with this project are described in the Purpose and Need section of Chapter 1.

This alternative was considered but eliminated from further study. This alternative does not meet the purpose and need of reducing the risk and consequence of stand replacing fire while insuring public and firefighter safety or meet the need to create a more resilient forest (Chapter 1).

Recent fuel treatment and fire severity assessments show fuel treatments do reduce fire severity. The Angora Fire 2007 (Murphy and others, R5-TR-025), the Bell Fire 2005 (Moghaddas and Craggs 2007), and the Cone Fire 2002 (Skinner et al., 2004) are examples. The Angora Fire Assessment states that hand thinning treatments on steep slopes were only partially effective. Greater fuel reduction was required to achieve the same results on flat ground. A preliminary report by Dr. JoAnn Fites from the Antelope Complex-Wheeler Fire Rapid Fire Behavior Assessment states that "The fire was so intense that although there is evidence that it dropped to the ground in the treatment areas (crowns were scorched in most of the treated areas but totally consumed in surrounding areas) but the fire overall was little affected. A larger expanse of treated area would possibly have resulted in a more moderating effect of fire behavior." A key finding from this report was that "treated areas had significantly reduced fire behavior and tree and soil impacts compared to untreated areas," and makes the recommendation that Managers should "consider treating larger portion of landscapes to effectively reduce the likelihood of fire gaining momentum and increasing in behavior to a point where suppression and treatments become less effective.

**Alternative 10: Unconstrained Restoration**

This alternative would develop forest structures and processes that closely match those of the historic forest of the 1850s. This alternative would be unconstrained by requirements to maintain canopy cover or tree distributions. This alternative would leave 20 to 60 of the largest trees per acre. Canopy cover would be substantially lower than current canopy covers in order to mimic what is understood to have been the historic condition. Many ponderosa pine and pine dominated mixed conifer stands would have canopy cover less than 40 percent. A lack of large trees over 35 inches (diameter at breast height) dbh would be present. Stands would continue to be dominated by medium size trees even though the number of trees would mimic the historic condition. Fire would be allowed to burn during the summer period when historic fires generally occurred. The prescribed fire program would increase to 25,000 to 50,000 acres treated per decade. This alternative would mechanically treat and/or burn 72,000 acres across the Kings River Project.

Several factors eliminated this alternative from detailed consideration. Forest managers believe unconstrained restoration would create open stands that would be negative for short-term needs of fishers and spotted owls. Sufficient differences between the historic 1850 climate and the present climate exist raising questions about returning to a forest structure that resulted under a different climate. This alternative would have required more prescribed fire and mechanical treatment than the Forest Service believe they could reasonably perform given current constraints on smoke production, work force levels, and safety. This unconstrained restoration would move faster to the desired condition than forest managers; members of the public; or researchers were comfortable with. This alternative was not fully analyzed in favor of alternatives that limited management consistent with current forest management plans wildlife and resource concerns, and work force limitations.

**Comparison of Alternatives**

The following table displays the predicted outcomes associated with each alternative. Greater detail can be found in Chapter 3, environmental consequences. The overall project area is 132,000 acres. The area to be treated under all action alternatives is 13,757 acres.

**Table 2-8. Comparison of Alternatives**

| Component | Alt. 1 Uneven-Aged | Alt. 2 No Action | Alt. 3 Retain Large Trees | Alt. 4 Fisher Emphasis | Alt. 5 Thin from Below |
|---|---|---|---|---|---|
| Management Areas | 8 Units, 13,757 ac. | NA | 8 Units, 13,757 ac. | 8 Units, 13,757 ac. | 8 Units, 13,757 ac. |
| Adaptive Study | 2 Units | No Study | 2 Units | 2 Units | 2 Units |
| Prescriptions applied? | Uneven-aged and thin from below | NA | Uneven-aged and thin from below | PSW/CV and thin from below | Thin from below |
| Purpose and Need Achieved? | Yes | No | Yes | Yes | Partially |
| Wildfire Threat Acceptable? | Yes | No | Yes | Yes | Yes |
| Fisher Protection Acceptable? | Yes | No | Yes | Yes | Yes |
| Wildlife sustainability threatened? | No | Yes, from fire | No | No | No |
| Develops large trees faster? | Yes | No | Yes | Yes | Partially |
| Reduce risk of insect losses? | Yes | No | Yes | Yes | Partially |
| Acres Treated Mech. | 7360 acres | 0 | 7269 acres | 7269 acres | 7269 acres |
| Acres Treated Fire | 9369 acres | 0 | 9369 acres | 9369 acres | 9369 acres |
| Herbicide Use | 947 acres | 0 | 856 acres | 856 acres | 856 acres |
| Herbicide Risk to people? | Negligible | No | Negligible | Negligible | Negligible |
| Small Groups | 91 acres | 0 | 0 | 0 | 0 |
| WUI Defense tot. ac. | 3274 acres | 0 | 3274 acres | 3274 acres | 3274 acres |
| WUI Threat tot. ac. | 4898 acres | 0 | 4898 acres | 4898 acres | 4898 acres |
| DFPZ acres | 1865 acres | 0 | 1865 acres | 1865 acres | 1865 acres |
| Treated Outside Fuel Zones | 3717 acres | 0 | 3717 acres | 3717 acres | 3717 acres |
| Harvest Limit, dbh | 35 inches | NA | 30 inches | 30 inches | 20 inches |
| Fisher Den Sites | Protected | NA | Protected | Protected | Protected |
| Fisher LOP, March 15 – June 15 | Known Occupied Dens | Known Occupied Dens | Known Occupied Dens | Same + additional protection | Known Occupied Dens |

| | | | | in SSFCA | |
|---|---|---|---|---|---|
| Owl LOP | All PACs | All PACs | All PACs | All PACs | All PACs |
| Avg. Trees/Ac > 30 in. (Before/After) | 6/5 | 6 | 6/6 | 6/6 | 6/6 |
| Avg. Trees/Ac 20 to30 in. (Before/After) | 20/18 | 20 | 20/18 | 20/18 | 20/20 |
| Avg. Canopy Cover WUI Defense | 60/49 percent | 60 percent | 60/49 percent | 60/49 percent | 60/51 percent |
| Avg. Canopy Cover WUI Threat | 62/54 percent | 62 percent | 62/54 percent | 62/54 percent | 62/55 percent |
| Avg. Canopy Cover DFPZ | 67/55 percent | 67 percent | 67/54 percent | 67/54 percent | 67/57 percent |
| Avg. Canopy Cover General Forest | 57/48 percent | 57 percent | 57/48 percent | 57/48 percent | 57/49 percent |
| Commercial timber volume | 27 MMbf | 0 | 22 MMbf | 21.5 MMbf | 15 MMbf |
| PNV | $18,237,000 | $8,134,000 | $17,609,000 | $17,561,000 | $16,618,000 |

PSW – Strategis disclosed in detail in Appendix I, CV – Strategies disclosed in detail in Appendix H