

**EXECUTIVE SUMMARY**

**CLEAR CREEK/KINGS CANYON**

**LANDSCAPE ANALYSIS AND STRATEGY**

*Submitted to:*

USDA FOREST SERVICE  
Humboldt-Toiyabe National Forest  
Carson Ranger District  
Carson City, Nevada

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*Submitted by:*



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# **CLEAR CREEK/KINGS CANYON LANDSCAPE ANALYSIS AND STRATEGY**

## **EXECUTIVE SUMMARY**

### **BACKGROUND**

#### **Study Objectives and Approach**

The Clear Creek/Kings Canyon strategy provides a vision for management of National Forest System lands in Clear Creek, Kings Canyon, and Voltaire Canyon. The objective of this landscape analysis is to provide essential background information for future site-specific decisions, to set priorities for management actions, and to identify management situations needing attention. While this document does contain specific recommendations, it is not a decision document. Any ground-disturbing, site-specific action that would be undertaken as a result of these recommendations will require compliance with the National Environmental Policy Act, which includes an environmental analysis and opportunities for public comment.

The Clear Creek/Kings Canyon landscape analysis and strategy focus on the key questions identified to be most relevant for land and resource management. The issues and associated key questions identified by the U.S. Forest Service and the public include: (1) Vegetation and Fuels, (2) Recreation, (3) Scenery Management, (4) Wildlife, (5) Watershed, (6) Roads Management, (7) Cultural Resources, and (8) Law Enforcement. Baseline conditions are characterized in the landscape analysis using the best available information.

#### **General Setting of Analysis Area**

The Clear Creek/Kings Canyon analysis area is located on the Carson Ranger District of the Humboldt-Toiyabe National Forest in western Nevada (Map 1). The analysis area is located in Carson City and Douglas County, Nevada. It encompasses approximately 17,000 acres, of which 10,000 acres are National Forest System lands located west of U.S. Highway 395 near Carson City, Nevada, along the California-Nevada border. The landscape analysis area includes the Clear Creek (10,234 acres), Kings Canyon (4,165 acres), and Voltaire Canyon (2,461 acres) sub-areas.

Land ownership status in the Clear Creek/Kings Canyon analysis area is 60.0 percent in National Forest System lands, 31.1 percent in private lands, 3.8 percent in Nevada state lands, and 1.9 percent in mixed (private/tribal). The U.S. Forest Service land allocations applicable to the analysis area, based on the Sierra Nevada Forest Plan Amendment, include Old Forest Emphasis Areas, Protected Activity Centers (California spotted owl and northern goshawk Protected Activity Centers [PACs]), Riparian Conservation Areas (RCAs), Urban Wildland Intermix Zones (Defense Zone and Threat Zone), and General Forest (Map 2).

## **Public Involvement and Partnerships**

The U.S. Forest Service involved the public and local government agencies to help identify issues and land/resource management concerns for the Clear Creek/Kings Canyon landscape analysis. A public meeting was held in March 2003, which was attended by about 40 local residents and agency representatives. In addition, a short article about the landscape analysis was published in "The Flow", a newsletter by the Carson Water Subconservancy District. An overview of the landscape strategy was presented to the Clear Creek Watershed Council at one of their regular meetings. Agencies consulted include Carson City, Douglas County, the Washoe Tribe, and Nevada Department of Transportation. The U.S. Forest Service worked in close cooperation with Carson City Department of Recreation and Open Space staff in developing the recreation issues and associated recommendations. The Nevada Division of Forestry, Nevada Department of Wildlife, and Nevada Division of Water Resources provided relevant background information for the landscape analysis.

## **VEGETATION AND FUELS**

### **Key Findings**

Past natural disturbances, land use/management, and fire exclusion have contributed to the current altered forest conditions and landscape pattern in the Clear Creek/Kings Canyon analysis area. Forest growth has contributed to increased fuel hazards, which in turn have increased the risk of loss or degradation from wildfires in the montane conifer forests. Higher tree densities now compared to historical conditions also increase the forest's susceptibility to insects and disease. Wildfires-related forest disturbances and recreation-related human activities increase the risk of noxious weed or invasive plant infestations.

In the Clear Creek/Kings Canyon analysis area, the increased risk of catastrophic wildfires threatens properties, structures, and other ecosystem values within National Forest System lands and adjacent private lands. Landscape-level vegetation and fuels management strategies are needed to restore the forest and reduce fuels, and to effectively modify existing wildfire patterns. Efforts to reduce hazardous fuels are underway on private lands in the Clear Creek watershed. There are potential opportunities to enhance fire and fuels management at the landscape-scale by coordinating and prioritizing the activities on National Forest System lands in conjunction with private lands.

## Recommendations:

### ***Vegetation and Fuels***

- Treat vegetation/fuels to reduce wildfire risk/hazard in the Clear Creek, Kings Canyon, and Voltaire Canyon areas. Vegetation/fuels treatment strategy include the following:
  - Treat fuels in the eastern edge of Section 5 (T14N, R19E), adjacent to the proposed golf course development (the Schneider Ranch property) (Map 3). Work with the developer to design more fire-safe conditions and reduce wildfire hazard/risk in the area.
  - Treat fuels in the area just south of U.S. Highway 50 in the southeast corner of Section 33 (T15N, R19E), directly west of the Nevada State Youth Camp (Map 3). The construction of an underpass associated with the Schneider Ranch property development is tentatively proposed just east of this area.
  - Reduce hazardous fuels by effectively treating dense sagebrush cover type, thus creating a fuelbreak near existing homes in the northeast portion of Section 23 (T15N, R19E) in the Kings Canyon area (Map 3).
  - Design fuel treatments cooperatively with the Nevada Division of Forestry, Carson City Fire Department, East Fork Fire District, and Douglas County for the Clear Creek watershed. Fire/fuels management is complex for this area as a result of the existing wildland urban interface communities.
  - Apply strategically placed area treatments (SPLATs) to effectively modify the wildland fire behavior and interrupt fire spread across the landscape (Map 3). The layout of the SPLATs should be modified as required by on-the-ground information.
  - Use mechanical thinning and/or prescribed fire for vegetation/fuels treatments in the SPLATs. Vegetation/fuels treatments should be consistent with the standards and guidelines outlined in the Sierra Nevada Forest Amendment (USDA Forest Service 2001a).
  - Use prescribed fires as follow-up fuels reduction treatments after stand structure modification by mechanical methods in the SPLATs. Use mechanical treatments such as mastication and piling when burning opportunities are limited because of concerns that the smoke may affect air quality.
  - Use mechanical treatments and/or prescribed fires to maintain the existing fuelbreak in the southwest portion of the Clear Creek area (Map 3).
  - Use mechanical thinning and/or prescribed fire for fuel reduction treatments in Old Forest Emphasis Areas and Riparian Conservation Areas (RCAs) within the proposed SPLATs (Maps 2 and 3). Use prescribed fires in RCAs to restore and enhance selected fire-adapted riparian vegetation and to reduce conifer encroachment in riparian and aspen cover types.

- Consider the use of grazing animals to reduce fuels in cheatgrass-dominated areas.

### **Noxious Weeds and Undesirable Plants**

- Survey and map the occurrence and distribution of noxious weeds and undesirable plants. Focus surveys on travel corridors, recreation facilities, and recently burned areas.
- Manage the known occurrences of noxious weeds using an integrated weed management approach that establishes treatment priorities. Work with local weed management groups to ensure that noxious weeds are effectively being managed.

## **RECREATION**

### **Key Findings**

Recreational use, including mountain biking, off-highway vehicle (OHV) use, hiking, picnicking, camping, cross-country skiing, hunting, and fishing, of the Clear Creek/Kings Canyon analysis area is high as a result of the area's proximity to population centers such as Lake Tahoe, Carson City, and Douglas County. The residents of the Carson Front Range and other out-of-town visitors are demanding public access to more recreation opportunities. Hence, there is a need for additional looping trails system and developed recreation facilities such as day use areas and trailheads.

Recreation facilities on National Forest System lands should be linked with public facilities on Carson City and Douglas County lands by designating existing routes as potential connector trails, developing trailheads and parking facilities, and building new connector trails. Improvements for public recreation uses could include day use areas, motorized and non-motorized trails, and other facilities.

### **Recommendations:**

#### **Day Use Area**

- Create a day use area in Kings Canyon. The proposed Borda Meadows day use area (locally referred to as Griffith Grove), which would be accessed from a spur road off of Kings Canyon Road, should be developed in partnership with Carson City (Map 4).

#### **Trailheads**

- Lower Kings Canyon Trailhead: This trailhead would be located on National Forest System lands off of Carlisle Court (near Kings Canyon Road) (Map 4). It would connect a National Forest System non-motorized trail with Carson City streets and trails through an existing public access easement.
- Borda Meadows Trailhead: In partnership with Carson City, improve the trailhead parking area and expand the information center located on National Forest System lands (Map 4).

- Upper Kings Canyon Trailhead: Create a trailhead, parking area, and information center (Map 4). Opportunities exist to access the scenic vista point to the southeast and connect to the Borda Meadows Day Use Area to the east via a trail.
- Voltaire Canyon Trailhead: In partnership with Carson City, create an OHV staging area with an information center in Voltaire Canyon near the Carson City watertank (Map 4). This facility will provide information on designated four-wheeled drive routes and guide OHV use in the area.
- Fuji Park: Establish an information center in Fuji Park in cooperation with Carson City to educate the public about the recreation opportunities in the area (Map 4).
- Clear Creek Trailhead: Improve the trailhead parking area along the Old Clear Creek Road, west of the Nevada State Youth Camp (Map 4). An opportunity exists to work with Douglas County and the Schnieder Ranch developers to improve the existing trailhead facilities or create new facilities on private property.
- Spooner Summit Day Use: Improve the existing Spooner Summit day use area and trailhead for year-round uses (Map 4). Explore ways for visitors using the Tahoe Rim Trail, Clear Creek Road, and Kings Canyon Road to safely cross U.S. Highway 50.

### **Non-Motorized Trails**

- Kings Canyon Area: In partnership with Carson City, create a trail from the Upper Kings Canyon Trailhead to Borda Meadows Day Use area. Connect the Borda Meadows Day Use area to the Borda Meadows Trailhead and the Lower Kings Canyon Trailhead via new trail construction and conversion of existing two-track roads (Map 4).
- Capital to Capital Trail: In partnership with Carson City, explore the possibility of connecting Kings Canyon Road or other trails in the area with the Tahoe Rim Trail. This connection would facilitate the plan for a regional trail system from Sacramento, California to Carson City, Nevada.
- C Hill: In partnership with Carson City, connect C Hill with the trail system in Kings Canyon (Map 4). This would provide an additional connector to the trail system on National Forest System lands.
- Clear Creek Area: Retain the Old Clear Creek Road as a travel route for non-motorized use. Work with private landowners for developing a connector trail to link the Old Clear Creek Road to Spooner Summit Day Use area (Map 4).

### **Motorized Roads and Trails**

- Voltaire Canyon and Kings Canyon: In partnership with Carson City, designate a system of OHV use roads and trails. The road network would utilize existing roads and may involve the relocation of some road segments and new road construction. Using existing roads and trails identify a travel route from the Voltaire Canyon OHV trailhead to Kings Canyon.

- Kings Canyon Road: The Kings Canyon Road to Spooner Summit should allow access for public recreation use and be maintained for high clearance vehicle.
- Old Clear Creek Road: Maintain the Old Clear Creek Road from the Clear Creek Trailhead on National Forest System lands to Spooner Summit for fire-related access and administrative use.

## **SCENERY MANAGEMENT**

### **Key Findings**

The scenery of the Clear Creek/Kings Canyon analysis area is important to both residents and visitors to the Carson Front Range. It forms the scenic backdrop to the communities of Carson City and Douglas County. The scenic backdrop contributes significantly towards the quality of life for people and communities in the Northern Sierra. This area provides visitors arriving from the East with their first views of the Sierra mountainous landscape after hundreds of miles of the Great Basin desert scenery. It provides visitors from the West with their first views of the dramatic east slope of the Sierra Nevada, with elevation dropping from 7,100 feet at Spooner Summit to 4,500 feet at Carson City over the course of a few miles.

Both Carson City and Douglas County cite visual integrity as a major criterion when identifying prime open space. Past scenery management for National Forest System lands focused on maintaining a natural landscape along major travel corridors. The current Toiyabe National Forest Plan (USDA Forest Service 1986) protects scenery mainly along the U.S. Highway 50 corridor. This scenery management direction needs to be updated to protect vistas and scenic backdrop throughout the Carson Front Range.

### **Recommendations:**

- Amend the Toiyabe National Forest Plan (USDA Forest Service 1986) to update the scenery management objectives. The updated objectives should be a comprehensive, scenery management direction for key scenic areas, including the U.S. Highway 50 scenic corridor, the lands around well-traveled National Forest System trails, and the lands that form the scenic backdrop for Carson City and Douglas County.

## **WILDLIFE**

### **Key Findings**

Sagebrush/bitterbrush habitat is important breeding areas and winter range for mule deer. Increased development along the Carson Front Range, combined with the effects of periodic wildland fires, have resulted in loss and degradation of key winter range habitat and traditional migration/travel corridors for mule deer.

Old forest is key suitable habitat for California spotted owl, northern goshawk, flammulated owl, white-headed woodpecker, and American marten. Two old-growth Jeffrey pine stands (approximately 530 acres combined) are known to occur on National Forest System lands in



the upper reaches of Clear Creek watershed. The existing old forest is vulnerable to potential loss or degradation resulting from wildland fires.

## **Recommendations:**

- Sagebrush/Bitterbrush Habitat: Implement mule deer habitat improvements in this vegetative cover type, including seeding of fire-damaged lands with sagebrush and planting bitterbrush. Cheatgrass invasion may be a problem after fires; thus, cheatgrass control is essential for habitat restoration with native plant species. The habitat improvement projects could be a collaborative effort between the U.S. Forest Service, Mule Deer Foundation, and Nevada Division of Wildlife. Sagebrush habitat improvement areas for mule deer are identified in Map 3.
- Old Forest Habitat: Implement habitat maintenance and/or enhancement actions (including mechanical thinning and/or prescribed fire) to protect or improve old forest characteristics and reduce the risk of wildfire in and adjacent to this tree-dominated habitat stage. Old forest habitat protection area is identified in Map 3.

## **WATERSHED AND ROADS**

### **Key Findings**

Watershed resources are identified as a key value in the Carson Front area. Accelerated erosion and sedimentation in Clear Creek drainage was documented in an erosion assessment (PBS&J 2003). Forest roads (including segment of U.S. Highway 50) and associated gullies were documented as the most significant sediment sources in the Clear Creek watershed (PBS&J 2003; USDA Forest Service 1993a). In addition, loss of vegetative cover from wildfires could result in increased soil erosion and adverse impacts on water quality as a result of sedimentation.

### **Recommendations:**

- Coordinate with the Nevada Department of Transportation to implement the proposed watershed mitigation projects in the Clear Creek drainage. To the extent possible, the U.S. Forest Service should work with the Nevada Department of Transportation to implement the recommendations proposed in the PBS&J (2003) report for National Forest System lands (see Map 4 for locations of proposed projects). The proposed projects would include slope and gully stabilization or construction of sediment retention basins (see Appendix G for details).
- Repair road-stream crossings on Old Clear Creek Road and Kings Canyon Road on National Forest System lands to reduce sedimentation to Clear Creek and Kings Canyon Creek, respectively.
- Implement road maintenance to meet road management and water quality objectives for the Clear Creek/Kings Canyon landscape analysis area. Maintenance efforts for the travelways should be focused on existing road-stream crossings and roads in riparian conservation areas.

## **CULTURAL RESOURCES**

### **Key Findings**

Fifty-eight historic archaeological sites have been recorded in the Clear Creek/Kings Canyon analysis area. Of these sites, only a few have been evaluated for the National Register of Historic Places. The culturally significant resources include the Kings Canyon Road, Swift's Station, Rufus Walton Toll Road, and Clear Creek Flume/Spooner Summit Complex. Potential threats to the heritage resources in the analysis area consist of natural disturbances (e.g., soil erosion and wildland fires) and human activities (e.g., vehicular traffic, including OHV use). The National Historic Preservation Act of 1966 ensures the protection and enhancement of historic properties on National Forest System lands. A comprehensive and detailed management plan for cultural resources is needed for the analysis area.

The Washoe people have strong traditional ties to the area and are interested in National Forest System lands-related management activities and protection of natural and cultural resources. Tribal members actively use the Clear Creek, Kings Canyon, and Voltaire Canyon areas for traditional cultural purposes.

### **Recommendations:**

- Develop a management, interpretation, and maintenance plan for Kings Canyon Road in consultation with the Nevada State Historic Preservation Office. Nominate Kings Canyon Road for the National Register of Historic Places.
- Create interpretative products focused on logging and transportation during the Comstock era, the roles of Chinese and Basque immigrants in Sierra history, and the use of the area by Native Americans. The interpretive products could include heritage resources website, informational videos and pamphlets, and informative kiosk or signs.
- Establish a stewardship program aimed at monitoring important historic/heritage sites, such as Kings Canyon Road, Clear Creek Road, and Swift's Station.
- In partnership with the University of Nevada in Reno, plan and implement Passport in Time excavations for Swift's Station.
- Develop cultural resources interpretative materials for the lower Kings Canyon loop trails.
- In cooperation and consultation with the Washoe Tribe of Nevada and California, develop management and protection measures for traditional use areas that are located within the analysis area.

## **LAW ENFORCEMENT**

### **Key Findings**

The Clear Creek/Kings Canyon analysis area has substantial incidents of late-night outdoor parties, trash dumping, illegal campfires, and unauthorized OHV use. There is a need for increased law enforcement presence on National Forest System lands in this area.

### **Recommendations:**

- Develop an intergovernmental agreement with Carson City to patrol the future trailheads and parking areas along Kings Canyon Road, the proposed day use area in King's County, and Voltaire Canyon for nuisance activities.
- Increase public education of recreation opportunities and allowable activities. Updated materials on the access plan and allowable uses of the travel routes should be made available to the public. Increased signage and enforcement of rule violations are necessary for control of the nuisance activities to be effective.

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## LIST OF ABBREVIATIONS

%	percent
° C	degrees Celsius
° F	degrees Fahrenheit
4WD	four-wheel drive
BP	Before Present
CDFA	California Department of Food and Agriculture
cfs	cubic feet per second
DEM	digital elevation model
EAWS	ecosystem analysis at watershed scale
GIS	geographical information system
HRCA	home range core area
HTNF	Humboldt-Toiyabe National Forest
LTNSP	Lake Tahoe Nevada State Park
mi	mile
mi/mi <sup>2</sup>	miles per square mile
mi <sup>2</sup>	square mile
NDOT	Nevada Department of Transportation
NDOW	Nevada Division of Wildlife
NEPA	National Environmental Policy Act
NFSC	Nevada Fire Safe Council
NRHP	National Register of Historic Places
OHV	off-highway vehicle
PAC	protected activity center
RCA	riparian conservation area
RCO	riparian conservation objective
RMO	road management objective
ROD	Record of Decision
ROS	recreation opportunity spectrum
SPLATs	strategically placed area treatments
TA	total area
TMDL	total maximum daily load
TtFW	Tetra Tech FW, Inc.
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
USGS	United States Geological Survey
VQO	visual quality objective

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# CHAPTER 1. INTRODUCTION

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## 1.1 Purpose and Scope

The primary purpose of this project was to complete a landscape analysis for the Clear Creek, Kings Canyon, and Voltaire Canyon analysis area. This landscape analysis meets the objectives of the six-step process as outlined in the *Ecosystem Analysis at the Watershed Scale (EAWS)—The Federal Guide for Watershed Analysis* (RIEC 1995) and is consistent with the management direction of the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a). The current status (or ecological baseline conditions), the desired conditions, and the broad-scale trends of biophysical and social/cultural resources were characterized. Resource assessments led to several practical management applications, including the identification of resources at risk and opportunities to achieve desired conditions, the prioritization of corrective action for problem areas, and the characterization of risks and constraints associated with meeting resource management objectives. The landscape analysis was conducted in an integrative, methodological framework that adopts an ecosystem approach to adaptive natural resources management and ecosystem restoration.

## 1.2 Landscape Ecosystem Analysis Framework

The Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a) adopted ecosystem analysis as an approach to support resource management planning and monitoring. Ecosystem analysis is an issue-driven, integrated resource analysis framework that is focused by the key questions identified to be relevant for resource management. Ecosystem analysis of landscape/watershed scale is not a decision-making process; rather it is an analytical or stage-setting process for ecosystem-based management and to support better science-based decisions.

Ecosystem analysis establishes a consistent, landscape-wide approach and context for maintaining or restoring ecological conditions that meet desired conditions. It includes a dynamic process that synthesizes relevant information and incorporates adaptive management. Ecosystem analysis is continually updated with new information and findings to improve its value as a resource assessment that supports decision-making in a manner consistent with regulatory requirements and institutional policies. It can be used as an intermediate step to Regional- or Forest-level assessments to identify potential management opportunities that are subsequently developed as project-specific proposed actions requiring National Environmental Policy Act (NEPA)-compliant documentation and decisions.

The Clear Creek/Kings Canyon landscape analysis was conducted under the management direction of the Sierra Nevada Forest Plan Amendment for ecosystem analysis. The results of the ecosystem analysis are to be used to:

- Establish a consistent, landscape/watershed-wide context for maintaining or restoring desired ecological conditions, consistent with regulatory requirements and institutional policies;
- Identify opportunities in a landscape/watershed context for site-specific project-scale environmental analysis;

- Identify opportunities for reducing fire risk and hazards, such as those associated with catastrophic wildland fires in the Sierra Nevada; and
- Facilitate program and budget development by identifying priorities for ecological, cultural, social, and economic needs in watersheds.

### 1.3 Interdisciplinary Approach

An interdisciplinary perspective was used to perform the Clear Creek/Kings Canyon landscape analysis. Technical specialists from the Humboldt-Toiyabe National Forest (HTNF) formed an interdisciplinary, collaborative team with resource analysts from Tetra Tech FW, Inc. (TtFW), an environmental consulting company. The joint interdisciplinary team included individuals with expertise in the following technical focus areas: forest and rangeland vegetation, fire and fuels, recreation, scenery management, land use planning, wildlife species and habitats, plant species and noxious weeds, geology and soils, hydrology, hillslope and fluvial geomorphology, forest roads, cultural resources, geospatial databases, and landscape/watershed ecology and disturbances. Table 1-1 lists the members of the U.S. Forest Service (USFS) and TtFW’s interdisciplinary teams.

**Table 1-1. Interdisciplinary Teams for the Clear Creek/Kings Canyon Landscape Analysis**

USFS Interdisciplinary Team		TtFW Interdisciplinary Team	
Name	Role/Discipline	Name	Role/Discipline
Gary Schiff	Carson District Ranger	Malcom Pious	Project Manager/ Interdisciplinary Team Lead/Wildlife
Sally Champion	Contracting Officer’s Representative/Interdisciplinary Team Lead/Watershed	Summer Adamietz	Recreation/Visuals/Law Enforcement
Dave Loomis	Planning	Joni Urbanski	Vegetation and Fuels
Ed DeCarlo	Lands	Jenna Farrell	Cultural Resources
Paddy Hardy	Recreation	Stephanie Phippen	Road Management/Watershed Resources
Maureen Easton	Wildlife	Chris Niemcek	Geographic Information System
Roland Shaw	Vegetation	Nicole Brown	Associate Analyst
Kelly Martin	Fire and Fuels	Tom Stewart, PhD	Senior Technical Review
Terry Birk	Cultural Resources		
Kathy Branton	Geographic Information System		
Larry Randall	Recreation/Visuals		
Erick Walker	Natural Resources		
Jason Kling	Fisheries		

The interdisciplinary teams from USFS and TtFW assembled, integrated, and synthesized the best available information for the landscape analysis. This integrated resource analysis, following steps 1 through 6 of the EAWS, is reported in a focused and concise document that synthesizes relevant and essential background information to address the issues-related key questions. Data gaps and limitations relative to data needs and availability are addressed for the purpose of subsequent iterations of similar analysis.

## 1.4 Public Involvement and Partnerships

The USFS involved the public and local government agencies to help identify issues and land/resource management concerns for the Clear Creek/Kings Canyon landscape analysis. A public meeting was held in March 2003, which was attended by about 40 local residents and agency representatives. In addition, a short article about the landscape analysis was published in "The Flow", a newsletter by the Carson Water Subconservancy District. An overview of the landscape strategy was presented to the Clear Creek Watershed Council at one of their regular meetings. Agencies consulted include Carson City, Douglas County, the Washoe Tribe, and Nevada Department of Transportation. The USFS worked in close cooperation with Carson City Department of Recreation and Open Space staff in developing the recreation issues and associated recommendations. The Nevada Division of Forestry, Nevada Department of Wildlife, and Nevada Division of Water Resources provided relevant background information for the landscape analysis.

## 1.5 Report Organization

The organization of the Clear Creek/Kings Canyon landscape analysis report follows the general sequence of the six-step process of the EAWS (steps 1 to 6) framework:

- Executive Summary;
- Chapter 1—Introduction;
- Chapter 2—Landscape Characterization (EAWS Step 1);
- Chapter 3—Issues and Key Questions (EAWS Step 2);
- Chapter 4—Current Conditions (EAWS Step 3);
- Chapter 5—Desired Conditions (EAWS Step 4);
- Chapter 6—Synthesis and Interpretations (EAWS Step 5);
- Chapter 7—Recommendations (EAWS Step 6); and
- Appendices.

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## **CHAPTER 2. LANDSCAPE CHARACTERIZATION**

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### **2.1 Study Location and Area Description**

The Clear Creek/Kings Canyon landscape analysis area is located on the Carson Ranger District of the HTNF in western Nevada (Map 2-1). The landscape analysis area is located in Carson City and Douglas County, Nevada. Approximately 78 percent of the analysis area is located in Carson City. The analysis area encompasses approximately 17,000 acres, with approximately 10,000 acres of National Forest System lands, located west of U.S. Highway 395 near Carson City, Nevada, along the California-Nevada border. U.S. Highway 50, Clear Creek Road, Kings Canyon Road, and several other National Forest System roads access the landscape analysis area. The landscape analysis area includes the Clear Creek (10,234 acres), Kings Canyon (4,165 acres), and Voltaire Canyon (2,461 acres) subareas.

The Clear Creek/Kings Canyon landscape analysis area lies between Eagle Valley and Lake Tahoe, within the eastern slope of the Sierra Nevada Mountains. The headwaters of the analysis area follow the watershed divide on the Carson Range of the Sierra Nevada. Clear Creek and Kings Canyon are headwater tributaries to the Carson River to the east. Voltaire Canyon includes several relatively small first-order tributaries that also drain eastward to the Carson River. The eastern extent of the landscape analysis area follows mostly north-south trending lines instead of watershed boundaries. The Clear Creek, Kings Canyon, and Voltaire Canyon subareas do not follow the U.S. Geological Survey fifth- or sixth-level hydrologic unit boundaries or the hierarchical framework of nested watersheds. The fifth-level hydrologic units in the landscape analysis area include the entire Clear Creek watershed (extending beyond the analysis area) and the combined Kings Canyon and Voltaire Canyon drainages (also extending beyond the analysis area). At the sixth-level, the Voltaire Canyon subarea consists of portions of three hydrologic units.

Carson City lies to the east of the landscape analysis area in the Eagle Valley at an elevation of approximately 4,600 feet. The area surrounding and east of Carson City is within the Great Basin, the heart of the Basin and Range Province of North America. The Basin and Range Province is a particular type of topography that extends east from the Sierra Nevada all the way to the Colorado Plateau. The Sierra Nevada drops off abruptly to the Great Basin region to the east and more gradually to the west. In 1859, the Comstock Lode was discovered in the Sierra Nevada near Carson City. Silver and gold were mined from the area, and there are several historic mines located within the Clear Creek/Kings Canyon landscape analysis area, based on information presented on USDI Geological Survey (USGS) topographic maps of the analysis area.

### **2.2 Biophysical Environment**

#### **2.2.1 Landforms and Geology**

The Clear Creek/Kings Canyon landscape analysis area falls within the Carson Range, a north-trending spur of the Sierra Nevada. The Carson Range rises abruptly to the west of the valley floor and reaches over 9,200 feet. The Sierra Nevada is a largely north-south trending mountain chain that was formed over several hundred million years by diverse geological activities that include uplift, erosion, volcanism, and glaciation. The resulting formations are dominated by granite, but many types of igneous, sedimentary, and metamorphic rocks, with ages from Cambrian (about 500 million

years old) to Quaternary (the past two million years) are present as well. Most evidence suggests that the modern range is about 10 million years old (University of California 1996). The landscape analysis area is largely underlain by granitic rocks of the Carson Range that have produced relatively thin, rocky, and coarse-grained soils (USDA Soil Conservation Service 1979, 1984). These sandy soils tend to be poorly developed and have naturally low fertility and water-holding capacity (USDA Soil Conservation Service 1979, 1984). The lack of silt and clay allows water to pass quickly through relatively cohesionless soil particles.

The highest point in the Clear Creek/Kings Canyon landscape analysis area is 9,165 feet at Snow Valley Peak in the northern headwaters of Clear Creek. Another relatively high point occurs at the junction of the Clear Creek, Kings Canyon, and Voltaire Canyon subareas, at an elevation of 8,695 feet. The lowest points in the Clear Creek/Kings Canyon landscape analysis area occur in the stream channels at the eastern extent of the area. These low points reach less than 4,760 feet in the Kings Canyon channel and less than 4,800 feet in the Clear Creek channel. Slopes within the landscape analysis area range from flat to greater than 65 percent. In general, most slopes fall between 21 and 40 percent.

The dissected granitic geology of this area produces dendritic drainage patterns throughout much of the Clear Creek/Kings Canyon landscape analysis area. The drainage density throughout the area is approximately 2.2 miles per square mile. The main streams in the landscape analysis area range from first and second order in Voltaire Canyon to third (Kings Canyon Creek) and fourth order (Clear Creek) (Strahler 1952).

### **2.2.2 Climate**

Summers in the Clear Creek/Kings Canyon landscape analysis area are warm, particularly at lower elevations, and winters are cool. At lower elevations near Carson City, precipitation is normally light throughout the year. At higher elevations in the headwaters, precipitation is much greater and snow accumulates to a considerable depth. Average temperatures in Carson City range from approximately 35 to 66 degrees Fahrenheit (°F) (Western Regional Climate Center 2003). Temperatures are cooler at higher elevations within the Clear Creek/Kings Canyon landscape analysis area. Precipitation occurs as both rain and snow. Of the total annual precipitation, about 25 percent falls between April and September, which includes the growing season for most crops (USDA Soil Conservation Service 1984). Two years in ten, the rainfall from April through September is less than 1.25 inches. About 13 thunderstorms occur each year, approximately nine of which occur in the summer (USDA Soil Conservation Service 1984).

Snow and rainfall patterns in the landscape analysis area vary seasonally depending on the approach of moisture-bearing storm fronts from the Pacific Ocean and the rain shadow effect created by the Sierra Nevada. Average seasonal snowfall is 30 inches. The greatest depth of snow at any one time during the period of record was 15 inches (USDA Soil Conservation Service 1984). Every few years a blizzard accompanied by high winds strikes the area. Even at lower elevations, snow remains on the ground for many weeks. The highest stream-flows occur following rain-on-snow events. The average relative humidity in mid-afternoon during spring is less than 28 percent; during the rest of the year it is about 33 percent (USDA Soil Conservation Service 1984). Humidity is higher at night in all seasons, and the average humidity at dawn is about 60 percent. The prevailing wind is from the

west-northwest. The average wind speed, 8 miles per hour, is highest in April (USDA Soil Conservation Service 1984).

Drought occurs periodically in this region. The last period of drought occurred between 1987 and 1994 (Nevada Division of Environmental Protection 2003), and longer periods of drought are not uncommon. For example, several drought periods up to several centuries in length have been recorded in the last 2,000 years in the region surrounding Lake Tahoe (Lindstrom and others 2000; University of California 1996).

### **2.2.3 Hydrology and Water Quality**

The main stream channels that flow through the landscape analysis area are Clear Creek, Kings Canyon Creek, and Voltaire Canyon Creek. Clear Creek and Kings Canyon Creek flow as perennial streams, while Voltaire Canyon Creek is an intermittent stream. These streams flow to the east, outside of the analysis area boundary, to Carson River. A few small lakes (less than 5 acres) also form part of the hydrologic system of the landscape analysis area. Most of these are ephemeral lakes in meadows and wetland areas.

Stream gage flow data are available for Clear Creek, Kings Canyon Creek, and Carson River. The Carson River flows to the north-northeast, beginning in California and continuing through western Nevada. The East Fork and West Fork of the Carson River originate in the eastern slopes of the Sierra Nevada, with most of the watershed headwaters lying in Alpine County, California (USDA Soil Conservation Service 1984). The two forks meander through the valley and join east of the town of Genoa, Nevada. The Carson River recharges the groundwater within the Carson Valley, and the result is a high water table in large portions of the valley floor.

Runoff in the Clear Creek/Kings Canyon landscape analysis area has been affected by anthropogenic activities. Culverts and other features that concentrate or reroute flow, as well as vegetation/land-cover modifications, have resulted in more erosive runoff in some portions of Clear Creek (PBS&J 2003). The amount and timing of stream-flows in channels has also been affected to some degree by stream diversions in Kings Canyon and, to a lesser extent, Clear Creek.

Segments of both Clear Creek and the Carson River (downstream of the analysis area) have been included in the state of Nevada 303(d) list of impaired surface water bodies (EPA 2003). Approximately two-thirds of Clear Creek, beginning at the origin, was listed in the Clean Water Act 303(d) list for pH (EPA 2003).

### **2.2.4 Transportation System and Access**

The transportation network within the Clear Creek/Kings Canyon landscape analysis area includes several travel routes ranging from pedestrian foot trails to paved highways. U.S. Highway 50 passes through the landscape analysis area from east to west, and U.S. Highway 395 passes near the eastern edge of the area, from north to south through Carson City. In addition, National Forest System roads (maintained by USFS) and roads across private lands occur throughout the area. More than 70 miles of paved and unpaved roads exist in the Clear Creek/Kings Canyon landscape analysis area, as do approximately 8 miles of National Forest System trails. The roads and trails network on National Forest System lands are used for general travel access, motorized and non-motorized recreation, and other forest administrative needs.

## 2.2.5 Ecoregion and Vegetation

Bailey's (1995) *Description of the Ecoregions of the United States* presents a hierarchical framework for delineating ecological regions based on unique combinations of climate, physiography, soil type, and potential vegetation. The ecoregions of the United States are classified, in descending order, by domains, divisions, provinces, and sections. Based on Bailey's ecoregions, the Clear Creek/Kings Canyon landscape analysis area is located in Section M261E (Sierra Nevada) of the M261 (Sierran Steppe–Mixed Forest–Coniferous Forest–Alpine Meadow Province). The landscape analysis area is located within the Carson Range, a spur of the Sierra Nevada. The Carson Range combines characteristics of the Sierran mountain chain to the west with the mountains of the Great Basin to the east. The area to the east of the Clear Creek/Kings Canyon landscape analysis area is the Intermountain Semidesert and Desert Province.

The vegetation zones, based on altitudinal variation, in the Clear Creek/Kings Canyon landscape analysis area include subalpine forest, montane forest, pinyon-juniper woodlands (pygmy conifer), and sagebrush. Azonal vegetation communities in the landscape analysis area include riparian and lentic. Existing vegetation/land-cover types in the Carson Range include montane forest, montane parkland, montane shrub, sagebrush steppe, sagebrush scrub, pinyon-juniper, riparian, agriculture, water, barren, and urban (Charlet 1998; UNR 2003a). Major vegetation types within the landscape analysis area are sagebrush/shrub on the lower elevations and mixed conifer (pine and/or fir-dominated) at higher elevations. Forest types located in the Clear Creek/Kings Canyon landscape analysis area include Jeffrey pine (*Pinus jeffreyi*), ponderosa pine (*Pinus ponderosa*), mixed conifer, lodgepole pine (*Pinus contorta*), white fir (*Abies concolor*), red fir (*Abies magnifica*), whitebark pine (*Pinus albicaulis*), and quaking aspen (*Populus tremuloides*). Woodlands in the landscape analysis area are dominated by pinyon pine (*Pinus monophylla*) and pinyon-juniper (*Pinus monophylla/Juniperus spp.*). Shrublands are dominated by sagebrush (*Artemisia spp.*) and bitterbrush (*Purshia tridentata*). Grassland and meadows are also found within the Clear Creek/Kings Canyon landscape analysis area.

Vegetation composition and distribution are influenced by factors such as climate, elevation, slope, aspect, soil type, and disturbance regimes. Past natural disturbances and land use/management influenced the landscape vegetation patterns and ecosystem dynamics in the Carson Range. Human settlement in the Carson Range has potential impacts on the forest and shrubland composition and structure that subsequently contribute to the changes in fire hazard, watershed hydrology, and terrestrial habitats.

## 2.2.6 Wildfires, Insects, and Diseases

Fire is a natural disturbance regime and an agent of ecological change in many forested ecosystems in the western United States. Prior to European settlement, fire ignited by lightning or Native American Indians was the primary means of vegetative change. The natural recurrence intervals of wildfires in lower elevation vegetation types in the Sierra Nevada has changed as a result of fire exclusion in fire dependent ecosystems, changing climatic conditions, lack of fuel profile modifications (e.g., advanced forest succession and associated accumulations of forest biomass), and human activities (USDA Forest Service 2001b). Forest types with frequent, low-intensity fire regimes recover quickly, whereas forests with less frequent, more intense fire regimes take longer to recover (Campbell and others 2000).

In general, the climate and topography of the interior western United States help generate fires; lightning ignites fires, dry periods reduce the moisture content of vegetation, and the wind drives the flames. Natural fire regimes vary with vegetation types, and the fire regime types are modified by vegetative changes resulting from natural and human-induced disturbance processes. In the Clear Creek/Kings Canyon landscape analysis area, noticeable changing conditions in fire regimes are in the Jeffrey pine/ponderosa pine and mixed conifer (Jeffrey pine/white fir) forest types.

Insects and diseases are integral components of forest ecosystem function. The size and severity of insect or disease infestations are influenced by the biological characteristics of the insect or pathogen, availability of susceptible host materials, and favorable environmental conditions. In the Carson Range, drought since the 1970s has made the Jeffrey pine and white pine susceptible to bark beetles (UNR 2003a). Within the Clear Creek/Kings Canyon landscape analysis area, fir engraver beetle-caused tree mortality was found in mixed conifer forest type.

Forest succession (or vegetation change) is influenced by disturbances such as fire, insects, diseases, climate, and human activity. Disturbance processes dictate the direction and rate of vegetative change (Rogers 1996). While natural disturbance regimes, such as wildfires and insect outbreaks, are common and healthy for many forest types, they present more difficult management situations in developed and wildland interface areas (Rogers 1996). In the Clear Creek/Kings Canyon analysis area, large areas of developed and wildland interface are located in or near National Forest System lands.

### 2.2.7 Noxious Weeds

Weeds are native or non-native plants that are highly competitive and aggressive invaders of native plant communities. The introduction of such invasive plant species can drastically disrupt the landscape and natural succession dynamics of native plant communities. Noxious weeds or undesirable plant species threaten the biodiversity and ecosystem integrity of an area by altering existing ecological relationships. Weed infestations can impact vegetation, soils, wildlife, domestic livestock, riparian areas, recreation opportunities, human health, and economy (USDA Forest Service 2001b). Noxious weed control is important because these invasive species could potentially overtake the native plant communities. Types of areas most susceptible to weed infestations in National Forest System lands include roads, utility corridors, livestock concentration points, vegetation management projects, recreation sites, riparian areas, burned areas, and urban wildland intermix (USDA Forest Service 2001b). Noxious weed control—preventing invasions and controlling current infestations—is becoming part of the planning process for National Forest System lands management.

The Federal Noxious Weed Act of 1974 and National Undesirable Plant Management Act of 1990 provide the regulatory framework for controlling the introduction and spread of noxious weeds or undesirable plant species in the United States. Noxious weeds are designated by federal and/or state agencies. The top ten most noxious weeds in Nevada are the following:

1. Perennial pepperweed (*Lepidium latifolium*)
2. Leafy spurge (*Euphorbia esula*)
3. Diffuse knapweed (*Centaurea diffusa*)
4. Squarrose knapweed (*Centaurea squarrosa*)

5. Spotted knapweed (*Centaurea maculosa*)
6. Scotch thistle (*Onopordium acanthium*)
7. Musk thistle (*Cardus nutans*)
8. Russian knapweed (*Acroptilon repens*)
9. Yellow starthistle (*Centaurea solstitialis*)
10. Yellow toadflax (*Linaria vulgaris*)

In the HTNF, occurrences of whitetop/hoary cress (*Cardaria draba*), musk thistle, spotted knapweed, yellow starthistle, St. Johnswort (Klamath weed) (*Hypericum perforatum*), medusahead rye (*Taeniatherum caputmedusae*), and cheatgrass (*Bromus tectorum*) have been reported (USDA Forest Service 2001b). Limited surveys have been conducted to gather background information on the current extent and trends of noxious weeds and invasive non-native plants in the Clear Creek/Kings Canyon landscape analysis area.

### 2.2.8 Wildlife Species and Habitats

Species of special status or concern were used to develop the list of species considered in the Clear Creek/Kings Canyon landscape analysis. The species list includes threatened, endangered, sensitive, and management indicator species that occur in the bioregion and have a distribution range that potentially overlaps the landscape analysis area. Table 2-1 presents the long-list of wildlife and plant species that was compiled and considered for the landscape analysis. The species list includes eight species of birds, six species of mammals, and seven species of vascular plants. To focus the landscape analysis on relevant and essential resource management-related key questions, the northern goshawk, white-headed woodpecker, California spotted owl, flammulated owl, American marten, and mule deer were selected as focal species. These species were selected mostly based on the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a). The selected focal species are closely associated with old forests (large trees with multi-strata or single-stratum structure), riparian habitat, snags and downed woody material (or dead tree/wood), and shrublands/grasslands. Wildlife species such as the mule deer and mountain quail are associated with multiple habitat types, including openings and early seral stage. Habitat type of special concern for the mule deer is the sagebrush/bitterbrush within the foothills rangeland, especially in critical winter habitat. Pope (2003) found nesting mountain quail in old growth coniferous forest, mixed shrub and grasslands, regenerating clearcuts, and old burned areas. Late successional stage and riparian wildlife assemblages also include some species of neotropical migrant birds.

The Clear Creek/Kings Canyon landscape analysis area contains forest and woodland, grass and shrubland, and riparian cover types. The major habitat types identified in the landscape analysis area are montane coniferous forest (e.g., Jeffrey pine/ponderosa pine, mixed conifer, lodgepole pine, white fir, and red fir), montane shrub (e.g., mountain shrub and mountain sagebrush), and sagebrush scrub (e.g., sagebrush and bitterbrush) (Nevada GAP 1996). Other habitat types within the Clear Creek/Kings Canyon landscape analysis area include pinyon-juniper woodlands, riparian (lowland and montane), and grasslands (Nevada GAP 1996). Aquatic and meadow habitats can also be found in the landscape analysis area.

**Table 2-1. Wildlife and Plant Species that Potentially Occur in the Clear Creek/Kings Canyon Landscape Analysis Area Vicinity**

Taxa	Common Name	Scientific Name	Status
Birds	Bald eagle	<i>Haliaeetus leucocephalus</i>	FT
	Northern goshawk	<i>Accipiter gentiles</i>	FSS
	California spotted owl	<i>Strix occidentalis occidentalis</i>	FSS
	Flammulated owl	<i>Otus flammeolus</i>	FSS
	Great gray owl	<i>Strix nebulosa</i>	FSS
	White-headed woodpecker	<i>Picoides albolarvatus</i>	FSS
	Mountain quail	<i>Oreotyxx pictus</i>	FSS
	Williamson's sapsucker	<i>Sphyrapicus thyfoideus</i>	MIS
Mammals	Spotted bat	<i>Euderma maculatum</i>	FSS
	Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	FSS
	Wolverine	<i>Gulo gulo luteus</i>	FSS
	Pacific fisher	<i>Martes pennanti</i>	FSS
	American marten	<i>Martes americana</i>	MIS
	Mule deer	<i>Odocoileus hemionus</i>	MIS
Vascular Plants	Galena Creek rockcress	<i>Arabis rigidissima var. demota</i>	FSS
	Lavin's egg milkvetch	<i>Astragalus oophorus var. lavinii</i>	FSS
	Upswept moonwort	<i>Botrychium ascendens</i>	FSS
	Dainty moonwort	<i>Botrychium crenulatum</i>	FSS
	Tahoe draba	<i>Draba asterophora var. asterophora</i>	FSS
	Nevada willowherb	<i>Epilobium nevadense</i>	FSS
	Webber ivesia	<i>Ivesia weberi</i>	FSS

FT = USFS Threatened Species

FSS = USFS Sensitive Species

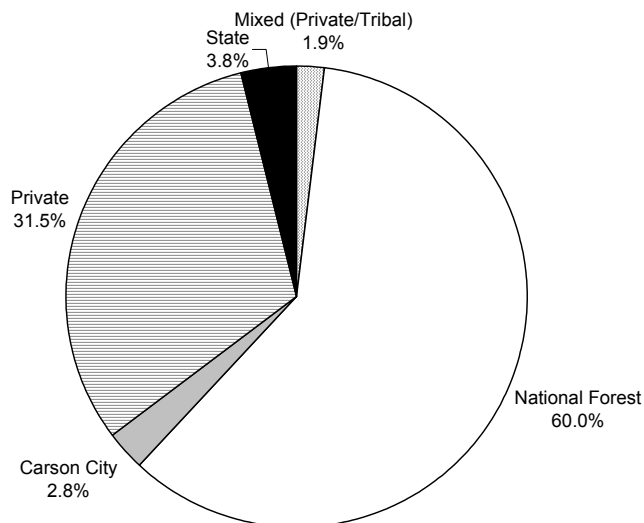
MIS =USFS Management Indicator Species

Sensitive wildlife and plant species status is based on the USFS Region 4 list (November 1995). This "short-list" only includes wildlife and plant species with probable occurrence in the Carson Range.

## 2.3 Social/Cultural Environment

### 2.3.1 Land Ownership

The Clear Creek/Kings Canyon landscape analysis area consists of National Forest, Carson City, Nevada state, tribal (Washoe Indian Tribe), and private lands (Map 2-2). Private homes are located within the landscape analysis area and at the mouths of the Clear Creek and Kings Canyon drainage basins. Land ownership status in the Clear Creek/Kings Canyon landscape analysis area is as follows: 60.0 percent in National Forest System lands, 31.5 percent in private lands, 3.8 percent in Nevada state lands, 1.9 percent in mixed (private/tribal) ownership, and 2.8 percent in municipal ownership (Figure 2-1). In the Clear Creek, Kings Canyon, and Voltaire Canyon subareas, the extent of National Forest System lands is 53.9 percent, 63.0 percent, and 80.5 percent, respectively. In the Clear Creek subarea, the extent of National Forest System and private (including mixed ownership) lands combined is 93.9 percent. A large extent of the private lands in the Clear Creek subarea is located north and south of U.S. Highway 50 in the eastern-southeastern portion of the watershed. The mixed land ownership pattern in the landscape analysis area adds to the complexity of management of the National Forest System lands.



**Figure 2-1. Land Ownership Status in Clear Creek/Kings Canyon Landscape Analysis Area**

### 2.3.2 Communities and Demographics

Nevada’s capital city, Carson City, abuts the eastern boundary of the Clear Creek/Kings Canyon landscape analysis area. Carson City has a consolidated city and county government. The city is approximately 143 square miles in size, and the urban development pattern generally follows the north-south corridor of U.S. Highway 395 (U.S. Census Bureau 2003). Carson City experienced a population growth of 29.7 percent from 1990 to 2000 (U.S. Census Bureau 2003), and its population was 52,500 in year 2000 (Carson City Chamber of Commerce 2003). The population is projected to increase by 25.9 percent over the next 20 years, or by approximately 69,000 residents in the year 2022 (State of Nevada Demographer 2003).

Douglas County had a population increase of 49 percent from 1990 to 2000. The county population was about 41,259 in year 2000 (U.S. Census Bureau 2003) and is expected to increase by 15 percent over the next 20 years, or by about 50,225 residents in the year 2022 (State of Nevada Demographer 2003).

The two most represented races in Carson City population are White (85.3 percent) and Hispanic/Latino (14.2 percent) (U.S. Census Bureau 2003). The median age is 39 years. The services industry is Carson City’s largest employer at 29.6 percent of the workforce (Carson City Chamber of Commerce 2003). Statewide, 52 percent of the workforce was employed by the services industry in 1997 (U.S. Census Bureau 1997). The employment base also relies on the government, retail trade, and manufacturing economic sectors. In 1998, the median household income was \$41,809, which was six percent higher than the median for the state (U.S. Census Bureau 2001).

In the Clear Creek/Kings Canyon landscape analysis area, approximately 78 percent of the population is located in rural Carson City. The 2000 U.S. Census reported approximately 846 people in the census block-group in which the landscape analysis area is located (Census Block Groups 2002). The census block-group area also includes communities between the Clear Creek/Kings



Canyon landscape analysis area and Lake Tahoe. There are approximately 383 housing units in the block-group overlapping the landscape analysis area, of which around 70 percent are owner occupied. The racial makeup of this block-group is mostly White (59 percent) and American Indian (30 percent). Most of the American Indian population is part of the Washoe Tribe, which has land holdings in the Clear Creek watershed.

Over the past 20 years, urban development of Carson City has spread from the old town to the corridor along Highway 395 and into subdivisions in rural Carson City. As a regional retail and wholesale trade center, Carson City attracts clientele from throughout adjacent areas to the east and west and as far south as Bishop, California. Carson City has a total trade area in excess of 225,000 square feet. In the 2001 fiscal year, Carson City retail and wholesale outlets did over \$8 million in business, out-performing fiscal year 2000 by 9.2 percent (Carson City Chamber of Commerce 2003).

Human influence in the analysis area vicinity is increasing. Construction of subdivisions with urban densities is becoming more widespread just east of the Clear Creek/Kings Canyon landscape analysis area in Carson City and south in Douglas County. A new golf course community that would be located in the southern portion of Clear Creek watershed is pending approval by Douglas County (S. Champion, personal communication 2003). The existing land uses and zoning pose a challenge to managing the adjacent National Forest System lands for ecosystem integrity and ecological sustainability.

### **2.3.3 Human Land Use**

#### **Current Uses**

The USFS manages the National Forest System lands that encompass approximately 60 percent of the Clear Creek/Kings Canyon landscape analysis area. The management direction for the National Forest System lands along the Carson Front includes public access, recreation, and scenic integrity. Main uses of the landscape analysis area include access to National Forest System lands for recreation and residential sites on privately owned land. The landscape analysis area is a popular recreational area for residents of Carson City who mountain bike, hike, picnic, camp, cross-country ski, hunt, and fish in the area.

U.S. Highway 50, which runs east-west and bisects the Clear Creek watershed, is a highly traveled route connecting Carson City with Lake Tahoe. The Clear Creek Road (Old Highway 50) and Kings Canyon Road provide access into more remote National Forest System lands in the analysis area for hiking, biking, equestrian, and/or off-highway vehicle (OHV) users. OHV use is a predominant recreational activity in Voltaire Canyon, located directly east of Carson City. There is some dispersed camping in Kings Canyon (USDA Forest Service 2003a). During the winter, snowmobiling on Spooner Summit is popular; a permitted outfitter/guide company leads this activity. The Washoe Tribe currently practices traditional subsistence, plant gathering, and religious activities on their ancestral lands, and considers the Clear Creek watershed important for cultural and environmental reasons.

#### **Historical Uses**

Euro-American settlement of the Tahoe Basin and Carson Range began in the early 19<sup>th</sup> century with the arrival of a few fur trappers/explorers and prospectors. The first Euro-Americans to survey

Lake Tahoe were John Fremont and his companion Charles Preuss in 1844 (Lindstrom and others 1994). During the mid 19<sup>th</sup> century, emigrant migration routes westward to California crossed the Carson Range. The 1859 discovery of the Comstock Lode, one of the largest silver deposits ever found in the United States, brought an influx of emigrant prospectors and laborers to western Nevada. The Comstock mines, northeast of Carson City, supported fledgling timber harvesting and water supply engineering industries and encouraged the growth of service and supply outposts along the heavily traveled freight and stage wagon toll routes within the Carson Range. Post-Comstock era (1890s to mid 1950s) land use in the area consisted of continued small-scale logging, domestic animal grazing, agricultural production, and outdoor recreational activities that have continued to present day, sustained by the construction of U.S. Highway 50.

The Clear Creek/Kings Canyon landscape analysis area includes a network of historic travelways (many derived from prehistoric trails) located near Spooner Summit. Some of these historic routes evolved into the modern transportation routes of today, such as U.S. Highway 50. Emigrants traveling west beginning in the 1850s used the Spooner Summit corridor. During the 1860s and 1870s, toll road routes were extensively used for freight and stage transportation and, by the 20<sup>th</sup> century, automobile travel prompted the construction of the first transcontinental highway, the Lincoln Highway, which later became U.S. Highway 50 (Lindstrom and others 1994). Important transportation-related historic sites recorded within the Clear Creek/Kings Canyon landscape analysis area include the Lake Tahoe Wagon Road (currently known as Kings Canyon Road) and the Rufus Walton Toll Road (currently known as Clear Creek Road).

Increased travel and freight transportation throughout the Clear Creek/Kings Canyon landscape analysis area led to the establishment of way stations (or stage stops) along the travel corridors. The way stations provided goods and services to travelers and generally included a store, a hotel, a saloon, a stable, and an emergency smithy (Hinkle and Hinkle 1949, in Lindstrom and others 1994). Swift's Station is a recorded historic way station located within the landscape analysis area and was an important large freight and stage stop located along the Kings Canyon Toll Road during the 1860s and 1870s. The current Kings Canyon Road was part of the Lincoln Highway and there are remnants of the original rockwork and Swift Station.

Innovative lumbering practices, combined with an intricate network of flumes, reservoirs, and pipelines, enabled the timber industry to extract lumber within the Clear Creek/Kings Canyon landscape analysis area and transport to the mines in the region (Lindstrom and others 1994). Haul roads, skid trails, long chutes, flumes, rafts, and railroads were used to transport timber. Evidence of this timber harvesting industry is preserved in a number of historic sites within the landscape analysis area such as the Clear Creek Flume, which aided in the long distance transport of lumber.

Foreign immigrants and ethnic and religious minorities provided much of the labor force for the timber and mining industries during the Comstock era. They included Chinese, German, Welsh, Irish, Mormon, Native American, French, and Canadian workers. Chinese companies and independent contractors formed to assist Chinese immigrants with job placement in the timber industry. Heritage resources within the Clear Creek/Kings Canyon landscape analysis area include artifacts (e.g., imported ceramics) associated with Chinese camps and laborers.

Post-Comstock era (1890s to 1950s) land use within the Clear Creek/Kings Canyon landscape analysis area continued the patterns of the Comstock era on a smaller scale. Small-scale timber

harvesting operations continued into the 20<sup>th</sup> century, as did seasonal cattle and sheep grazing. Basque herders continued traditional sheep herding in the Sierra Nevada until the 1940s, driving the sheep seasonally between upland and lowland pastures. In the 1950s, ranchers began to use trucks to transport sheep to the seasonal grazing areas as a result of competition between users of recreational lands and grazing lands. Sheep herding sites include such features as Basque carvings in aspen trees.

Historical land use in the Clear Creek/Kings Canyon landscape analysis area also included summer and winter recreation activities. In the 1930s, the White Hill Ski area was constructed on Spooner Summit, but was short-lived because of a lack of snow. Recreation use is still an important component of land use in the landscape analysis area, especially as public interest in mountain biking, hiking, off-road vehicle use, and interpretation of heritage resources continues to grow.

### 2.3.4 Prehistoric and Historic Culture

Human use of the Carson Range and Clear Creek/Kings Canyon landscape analysis area, including hunting, fishing, and plant gathering, is documented in the regional archaeological record. Archaeological discoveries and research in the Tahoe Basin region suggest that use of the area by hunting gathering peoples began with the early Holocene (10,000 years ago) and continued well into the historic era. Table 2-2 presents the prehistoric cultural chronology that is currently recognized for the Northern Sierra.

**Table 2-2. Northern Sierra Prehistoric Cultural Chronology**

Temporal Phase	Time Period	Characteristic Artifacts
Late Kings Beach	800 BP to Historic	Flaked obsidian, small projectile points, Desert side-notched points, cottonwood series, and bedrock mortars.
Early Kings Beach	1500–800 BP	Rosegate series projectile points.
Late Martis Phase	2500–1500 BP	Corner-notched Elko and Martis projectile point series.
Middle Martis Phase	3500–2500 BP	Leaf-shaped Elko and Martis projectile point series.
Early Martis Phase	4000–3500 BP	Contracting Stem Elko and Martis projectile point series.
Spooner Phase	4000–7000 BP	Pinot and Humboldt series projectile points.
Tahoe Reach Phase	7000–8000 BP	Wide-stem projectile points, Parman projectile points.

Source: Moratto 1984

Radiocarbon dates and artifact assemblages from archaeological sites within the region indicate intermittent evidence of human habitation beginning approximately 8,000 years before present in Truckee River Canyon and along Donner Creek (Elston and others 1977; Lindstrom and others 1994; Rondeau 1982). A pronounced increase in the intensity of human occupation started approximately 4,000 years before present. Later period archaeological sites within the region may represent the prehistoric antecedent lifeways of the ancestral Washoe, whose descendants inhabited the area into historical times (Lindstrom and others 1994).

The general archaeological trend for the Tahoe region is illustrated by increasing population density over time and a transition from the hunting-based culture to an increased dependence on diversity of plant resource utilization. Settlement and land use patterns within the Clear Creek/Kings Canyon landscape analysis area were focused around seasonal resource availability, with small groups using a network of established trails for travel between lower and higher elevations to reach seasonal localities and villages. Subsistence activities included exploitation of riverine resources (e.g., fish and

mussels), hunting, and seed, plant, and nut gathering. Plants were also gathered for utilitarian use. Although very few prehistoric sites have been identified within the landscape analysis area, the archaeological evidence in nearby regions with similar environmental conditions includes sites such as bedrock milling stations, rock features (e.g., hunting blinds and house rings), house depressions, trails, and lithic scatters.

The Clear Creek/Kings Canyon landscape analysis area encompasses the ethnographic territory of the Washoe people, members of the Hokan linguistic stock (d'Azevedo 1966; Kroeber 1925). The Washoe used every bioregion in the Sierra Nevada to obtain natural resources and often traveled long distances for such items. Because of the Washoe people seldom (if ever) assembled in a single place, estimates of their population during prehistoric and contact periods are widely disputed. Given the rich natural environment of the area, it is generally thought that they were capable of supporting a relatively large population. The geographic distribution of the Washoe is a matter of some controversy (see d'Azevedo 1966; Park 1938; Steward 1938; Steward and Wheeler-Voegelin 1974; Stewart 1939, 1966), although most researchers agree that Washoe territory centered on Lake Tahoe.

Like other Great Basin groups, the Washoe relied upon a seasonal subsistence-settlement strategy, but the abundance of resources within their territory allowed a relatively high degree of sedentism (Pendleton and others 1982). The bulk of the Washoe diet consisted of plant foods (especially pinyon) and readily available aquatic resources obtained from lacustrine and riverine environments. Collected for caching or immediate consumption, seed plants provided a convenient source of food in the spring and fall. Additionally, many varieties of plants and grasses were collected for medicinal and utilitarian uses.

Communal rabbit and antelope drives were often held in the fall, after the pinyon harvests were complete. These drives are rare examples of large-scale cooperation among the Washoe (Downs 1966; Lowie 1939). Using long nets made of sage fibers and/or stone dummies and diversions, or aided by controlled burning, people drove herds into traps, where the animals could be killed with ease. Weirs, fishing blinds and harpoons, rafts, or watercourse diversion methods were used for fish gathering.

The Washoe people inhabited the Tahoe Basin with little disturbance well into the mid-19<sup>th</sup> century, until the discovery of the Comstock Lode in 1859. The Euro-American and immigrant invasion displaced the Washoe fishing, hunting and gathering areas, and many of the native people were forced to work as ranch hands, construction workers, or servants. Today, the Washoe continue to maintain important traditional practices associated with their ancestral lands and maintain an active interest in land and resource management on National Forest System lands that have potential impacts on cultural sites and heritage resources.

## **2.4 Management Directions and Land Allocations**

The current management directions for land and resource management on the HTNF are consistent with the following laws, regulations, and directives:

- National Forest Management Act of 1976;

- National Environmental Policy Act of 1969 (as amended);
- Clean Water Act of 1972 (as amended);
- Endangered Species Act of 1973 (as amended);
- Clean Air Act of 1970 (as amended);
- Toiyabe National Forest Land and Resource Management Plan (USDA Forest Service 1986);
- Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a);
- USFS policies such as the National Fire Plan (USDA Forest Service and others 2002), Western Forest Health Initiative (USDA Forest Service 1994a), and Road Management (USDA Forest Service 2001c); and
- Other applicable management plan objectives and regulatory requirements (including tribal treaty rights and sovereignty).

The Sierra Nevada Forest Plan Amendment describes land allocations and associated standards and guidelines as management strategies to address: (1) old forest ecosystems and associated species, (2) aquatic and riparian ecosystems, (3) fire and fuels, (4) lower westside hardwood ecosystems, and (5) noxious weeds. Land allocations and standards and guidelines applicable to the Clear Creek/Kings Canyon landscape analysis area are as follows: Old Forest Emphasis Areas, California spotted owl and northern goshawk Protected Activity Centers (PACs), Riparian Conservation Areas (RCAs), Urban Wildland Intermix Zones (defense and threat), and General Forest. Under the Sierra Nevada Forest Plan Amendment, old forest emphasis areas and urban wildland intermix zones are USFS-mapped land allocations, while the California spotted owl PACs, northern goshawk PACs and RCAs are unmapped land allocations. The approximate locations of the mapped urban wildland intermix zones may be adjusted at the National Forest-level. Map 2-3 and Table 2-3 show the land allocations for the Clear Creek/Kings Canyon landscape analysis area.

**Table 2-3. USFS-Mapped Land Allocations in Clear Creek/Kings Canyon Landscape Analysis Area**

Land Allocation Type <sup>1</sup>	Clear Creek		Kings Canyon		Voltaire Canyon		Landscape Analysis Area		
	Area	Extent	Area	Extent	Area	Extent	Area	Extent	
	(acres)	(% TA)	(acres)	(% TA)	(acres)	(% TA)	(acres)	(% TA)	
Old Forest Emphasis Areas	1,437	14.0	0		0		1,437	8.5	
California Spotted Owl PAC	269	2.6	0		0		269	1.6	
Northern Goshawk PAC	445	4.3	0		0		445	2.6	
Riparian Conservation Area	762	7.4	471	11.3	231	9.4	1,466	8.7	
Urban Wildland Intermix	Defense Zone	1,249	12.2	1,207	29.0	1,440	58.5	3,896	23.1
	Threat Zone	5,001	48.9	375	9.0	0		5,376	31.9
General Forest	246	2.4	1,092		541	22.0	1,878	11.1	
Total Classified	9,409	91.9	3,145	75.5	2,212	89.9	14,767	87.6	
Total Unclassified	824	8.1	1,020	24.5	250	10.1	2,093	12.4	
<b>Total</b>	<b>10,233</b>	<b>100.0</b>	<b>4,165</b>	<b>100.0</b>	<b>2,462</b>	<b>100.0</b>	<b>16,860</b>	<b>100.0</b>	

TA = Total Area

1 Old Forest Emphasis Areas included National Forest System and Nevada state lands; California Spotted Owl and Northern Goshawk Protected Activity Centers only included areas within the Clear Creek/Kings Canyon landscape analysis area; Riparian Conservation Areas only included National Forest System lands; and Urban Wildland Intermix Zone included all land ownership.

Insert Maps 2-1, 2-2, & 2-3

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## **CHAPTER 3. ISSUES AND KEY QUESTIONS**

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The purpose of Chapter 3 (EAWS Step 2), develop issues and key questions, is to focus the analysis on the key elements of the ecosystem that are most relevant to management questions and objectives, human values, or resource conditions within the Clear Creek/Kings Canyon landscape analysis area. Core issues were framed and key questions were developed to evaluate resource conditions, identify potential management opportunities, and determine priorities for moving toward desired conditions. Each issue refers to a topic, a subject, or a value that has a high level of concern or interest and consequently triggers the analysis. The key questions are intended to focus the landscape analysis.

The identification of issues and key questions is consistent with the ecosystem analysis framework, a guideline within the Sierra Nevada Forest Plan Amendment Record of Decision (ROD) (USDA Forest Service 2001a), for an objective-driven, integrated resource analysis. The USFS interdisciplinary team developed the preliminary issues and key questions based on resource and management concerns and best professional judgment related to landscape-level resource conditions and potential management directions. Once the preliminary issues and key questions were identified, the joint interdisciplinary teams from USFS and TtFW refined the issues-related key questions.

In general, any lack of relevant and essential background information on ecosystem components, structures, and processes; general lack of scientific consensus; or questions of data reliability may limit the scope, depth, and intensity of a landscape analysis. The Clear Creek/Kings Canyon landscape analysis was completed using the best available information. During the project startup phase, TtFW performed a review to understand the status of baseline data or information for addressing the issues and key questions. Potential data sources, gaps, and limitations were identified. Existing data availability, resolution, and quality limit the depth and intensity of certain resource assessments. For example, incomplete or unavailable geographical information system (GIS) base layers and baseline condition data may preclude addressing certain key questions in detail. However, the key questions were maintained and not eliminated from the analysis so that program development priorities to address data needs could be identified. Landscape analysis is an incremental, knowledge-based process that incorporates new information and findings as they become available.

The following list of key questions (organized by issues) served as the framework for the Clear Creek/Kings Canyon landscape analysis.

### **3.1 Vegetation and Fuels**

1. What is the condition/health of the conifer and riparian forest in the Clear Creek/Kings Canyon analysis area?
2. Are there opportunities to reduce the risks and hazards associated with wildland fires by treating vegetation and fuels?

3. Can strategically placed area treatments (SPLATs) be implemented on the landscape? Where would these SPLATs be located? Will these treatments be feasible to implement and effective in reducing risk from fire?
4. Can treatments on National Forest System lands increase the effectiveness of the vegetation treatments implemented by homeowners in Clear Creek?
5. Are there opportunities to protect old, large-diameter trees and to increase the number of large diameter trees?
6. What should the Forest Service do to minimize the spread of noxious weeds?

### **3.2 Recreation**

1. What are the existing and potentially suitable recreational opportunities in the Clear Creek, Voltaire Canyon, and Kings Canyon area?
2. What kind of day-use facilities would be appropriate for the analysis area?
3. What is the existing motorized and non-motorized trail system in the analysis area? How can the trail system meet the appropriate recreation experience opportunity (based on Recreational Opportunity Spectrum [ROS]) for the area? What are the opportunities for connecting Clear Creek Road to Spooner Day Use Area, the Tahoe Rim Trail, and the proposed Douglas County trail network?
4. How can recreational opportunities on National Forest System lands best be integrated with recreation plans for Carson City and Douglas County?

### **3.3 Scenery Management**

1. What are the scenery management objectives for the analysis area? Are the visual objectives being met by the current conditions?
2. How would proposed projects affect the scenic integrity of the area?

### **3.4 Wildlife**

1. Are there opportunities to maintain and/or enhance existing sagebrush/bitterbrush habitat within the analysis area?
2. Can habitat for the northern goshawk, white-headed woodpecker, California spotted owl, flammulated owl, and American marten be enhanced through vegetation treatments? How will treatments to reduce risks from wildfire and expand recreational opportunities affect this habitat?

### **3.5 Watershed**

1. Where, and to what degree, is erosion from Highway 50 in the Clear Creek watershed impacting National Forest System lands?

2. What are the treatments Nevada Department of Transportation (NDOT) has proposed for erosion control on National Forest System lands? What is the timetable for completion?

### **3.6 Roads Management**

1. What is the existing road system in the analysis area? What would an appropriate road system look like? (Are there existing roads that are not needed? Are there roads that should be converted to trails? Are additional roads needed for recreation, fire protection and suppression, and vegetation treatment?)
2. What is the appropriate level of use and maintenance for the road system? What actions might be taken, and where, to improve the roads to accommodate these uses?

### **3.7 Cultural Resources**

1. What are the culturally significant resources and the potential threats to those resources? What are the cultural resources at greatest risk and what might be done to protect them?
2. What cultural resources should be interpreted for the public and how might that best be accomplished?

### **3.8 Law Enforcement**

1. How can the Forest Service best address law enforcement needs in the analysis area?

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## CHAPTER 4. CURRENT CONDITIONS

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The purpose of Chapter 4 (EAWS Step 3) is to describe the current landscape conditions relevant to the issues and key questions. Background information was assembled, integrated, and reviewed to provide detailed descriptions of current resource status and conditions. The best available information was used to document current conditions in the Clear Creek/Kings Canyon landscape analysis. Photo documentation of the current landscape features and components are presented in Appendix C.

### 4.1 Vegetation and Fuels

#### 4.1.1 Vegetation Composition and Distribution

In the Clear Creek/Kings Canyon landscape analysis area, vegetation cover types differ based on elevation. Elevations in the landscape analysis area range from 4,800 to 9,160 feet, so multiple vegetation zones were analyzed.

In the lowest elevations within the Clear Creek/Kings Canyon landscape analysis area, nonforest cover types dominate. The cover types include salt desert scrub, bitterbrush, and sagebrush. The saltbush and sagebrush shrublands zone transitions to pinyon pine and pinyon-juniper woodlands (also known as the pygmy conifer zone), which transition to coniferous forests within the montane and subalpine vegetation zones.

Yellow pine forest (ponderosa pine and Jeffrey pine) occurs in the lower elevation montane conifer forest, which transitions to Jeffrey pine, white fir, and red fir forests in the middle elevations and then to red fir in the upper montane zone. The upper montane zone is also referred to as lodgepole-red fir zone. Lodgepole pine forest type occupies the highest elevations (mostly above 7,000 feet), with red fir occurring on the north slopes. The upper montane zone transitions to the subalpine vegetation zone. Subalpine forest types consist of whitebark pine and western white pine with discontinuous and patchy distribution. Map 4-1 and Table 4-1 present the distribution of existing vegetation/land-cover types (based on Nevada GAP 1996) for the Clear Creek/Kings Canyon landscape analysis area.

#### Montane Forest Cover Types

##### *Yellow Pine*

In the lower montane zone, ponderosa pine is mixed with Jeffrey pine. Common conifer species associates in the yellow pine zone are sugar pine (*Pinus lambertiana*), incense cedar (*Calocedrus decurrens*), and white fir. Yellow pine forest types range from open stands, with grass or shrub understories, to dense, single-storied canopy stands. On moister sites, Jeffrey pine often dominates the overstory with white fir in the understory. The yellow pine forest type is commonly adjacent to sagebrush, bitterbrush, and mountain shrub cover types. Approximately 27.5 percent (4,629 acres) of the Clear Creek/Kings Canyon landscape analysis area is in Jeffrey pine/ponderosa pine cover type (Table 4-1).

**Table 4-1. Existing Vegetation/Land-Cover Types in Clear Creek/Kings Canyon Landscape Analysis Area**

Vegetation/Land-Cover Types	Crown Cover (%)	Clear Creek		Kings Canyon		Voltaire Canyon		Landscape Analysis Area	
		Area (acres)	Extent (% TA)	Area (acres)	Extent (% TA)	Area (acres)	Extent (% TA)	Area (acres)	Extent (% TA)
Aspen	> 59	44	0.4	97	2.3	0	0	141	0.8
Pinyon	< 30	27	0.3	31	0.8	36	1.5	95	0.6
	30-60	264	2.6	100	2.4	51	2.1	414	2.5
Pinyon-Juniper	< 30	8	0.1	4	0.1	0	0	13	0.1
	30-60	15	0.1	0	0	0	0	15	0.1
Lodgepole pine	< 30	16	0.2	0	0	0	0	17	0.1
	30-60	530	5.2	158	3.8	0	0	688	4.1
	> 59	91	0.9	22	0.5	0	0	113	0.7
Red fir	30-60	14	0.1	20	0.5	0	0	34	0.2
	> 59	150	1.5	62	1.5	0	0	212	1.3
Whitebark pine	< 30	5	<0.1	2	<0.1	0	0	7	<0.1
White fir	> 59	714	7.0	59	1.4	0	0	774	4.6
Jeffrey pine/ Ponderosa pine	< 30	84	0.8	29	0.7	0	0	113	0.7
	30-60	1,917	18.7	626	15.0	12	0.5	2,554	15.2
	> 59	237	2.3	9	0.2	0	0	246	1.5
Jeffrey pine/ Ponderosa pine/ Mountain shrub	—	1,154	11.3	562	13.5	0	0	1,716	10.2
Bitterbrush	—	527	5.1	325	7.8	299	12.1	1,151	6.8
Mountain sagebrush	—	171	1.7	128	3.1	0	0	300	1.8
Sagebrush	—	511	5.0	398	9.6	1,321	53.6	2,230	13.2
Sagebrush/ Perennial grass	—	998	9.8	439	10.5	423	17.2	1,860	11.0
Salt desert scrub	—	23	0.2	0	0	0	0	23	0.1
Mountain shrub	—	2,143	20.9	720	17.3	112	4.5	2,974	17.6
Grassland	—	162	1.6	138	3.3	99	4.0	399	2.4
Agriculture	—	0	0	176	4.2	5	0.2	182	1.1
Barren	—	188	1.8	13	0.3	59	2.4	260	1.5
Lowland riparian	—	70	0.7	0	0	0	0	70	0.4
Mountain riparian	—	165	1.6	47	1.1	0	0	212	1.3
Urban	—	2	<0.1	0	0	46	1.9	48	0.3
<b>Total</b>		<b>10,233</b>		<b>4,165</b>		<b>2,462</b>		<b>16,860</b>	

TA = Total area

Source: Nevada GAP Data (1996)

***Mixed Conifer***

Mixed conifer forest type is located in the middle to upper area of the montane zone. White fir and Jeffrey pine dominate the mid-montane mixed conifer forests. Annual precipitation in this vegetation zone averages 25 to 30 inches (USDA Forest Service 1993a). Jeffrey pine dominates the dry, south-facing slopes from approximately 6,200 to over 8,000 feet in elevation. The understory vegetation layer consists primarily of sagebrush, bitterbrush, erigonum (*Erigonum* spp.), Sierra

chinquapin (*Chrysolepis chrysophylla*), pinemat manzanita (*Arctostaphylos nevadensis*), and snowbrush (*Ceanothus velutinus*).

White fir and Jeffrey pine dominate gentler slopes and north and west aspects, extending generally between 6,200 and 7,800 feet in elevation (USDA Forest Service 1993a). Jeffrey pine tends to dominate the upper canopy layer at lower elevations. White fir is generally found in the lower canopy layer at all elevations. Red fir occurs within stands at the higher elevations. Forest canopy closures vary from open (less than 30 percent) to dense (greater than 60 percent). Understory vegetation is generally sparse. In canopy openings, sagebrush, bitterbrush, Sierra chinquapin, gooseberries and currents (*Ribes* spp.), snowberry (*Symphoricarpos* spp.), greenleaf manzanita (*Arctostaphylos patula*), pin cherry (*Prunus pensylvanica*), and pachystima (*Pachystima mayrsinites*) occur.

Forest types dominated by white fir and red fir generally occur between 7,500 feet elevation on north-facing slopes to 8,200 feet elevation on more southerly aspects (USDA Forest Service 1993a). Jeffrey pine occurs less frequently in these forest types. Western white pine (*Pinus monticola*) and lodgepole pine are a small component of the upper montane, mixed conifer forests. At the highest elevations, red fir dominates with white fir, Jeffrey pine, and lodgepole pine as its lesser associates. Stand structure is a mosaic of multi-storied and uniform forest patches. Pine-mat manzanita is the major understory vegetation in openings. Sierra chinquapin also occurs in this forest type. Mixed conifer forest type occurs primarily in the upper elevations of the Clear Creek watershed within the landscape analysis area. Approximately 4.6 percent (774 acres) and 1.5 percent (246 acres) are in the white fir and red fir forest types, respectively (Table 4-1).

### ***Lodgepole Pine***

The lodgepole pine forest type occurs at elevations of about 8,000 feet in the highest extents of the upper montane zone (Potter 1998). Depending on site conditions, these stands range between open stands to single-storied, dense canopied stands dominated by lodgepole pine, with western white pine, red fir, and whitebark pine as its common associates. Understory vegetation includes sagebrush, manzanita, snowbrush, gooseberries and currents. Approximately 4.9 percent (818 acres) of the Clear Creek/Kings Canyon landscape analysis area is in lodgepole pine forest type (Table 4-1). The lodgepole pine stands occur in the highest elevations of Clear Creek and Kings Canyon.

### ***Aspen***

Small patches of quaking aspen groves occur throughout the Clear Creek/Kings Canyon landscape analysis area. Aspen groves are found primarily at springs and seeps and along watercourses in riparian corridors. Aspen is the dominant species; willow (*Salix* spp.) and alder (*Alnus* spp.) are present in the understory. Conifers are encroaching upon aspen groves in upslope riparian areas, which lack fire-related disturbance. Less than 1 percent (141 acres) of the landscape analysis area is in aspen forest type (Table 4-1).

### ***Mountain Riparian***

Mountain riparian vegetation occurs in relatively narrow strips along perennial streams in steep draws in higher elevations. The riparian community along the streams, dominated by willow and alder trees, is often less than 50 feet wide. Bitter cherry (*Prunus emarginata*), mountain dogwood (*Cornus sericea*), and greenleaf manzanita also occur in the riparian vegetation (PBS&J 2003). In intermittent stream corridors, aspen dominates the riparian vegetation (USDA Forest Service 1993a). Conifers are becoming increasingly abundant within the riparian communities. Approximately 1.3

percent (212 acres) of the Clear Creek/Kings Canyon landscape analysis area is classified as high elevation riparian cover type (Table 4-1).

### **Subalpine Forest Cover Type**

Subalpine forests are composed of whitebark pine, lodgepole pine, and mountain hemlock (*Tsuga mertensiana*). Two small stands of whitebark pine occur adjacent to the lodgepole pine in the uppermost elevations of Kings Canyon and Clear Creek. The whitebark pine stands total approximately seven acres (Table 4-1).

### **Pinyon-Juniper Woodland Cover Type**

The pinyon-juniper zone occurs in lower elevation (below 6,000 feet) above the sagebrush scrub zone, and it is often intermingled with Jeffrey pine/ponderosa pine forests. The understory in this vegetation zone is commonly sparse and is composed primarily of sagebrush species and cool, season perennial grasses. Major species types in the pinyon-juniper woodlands include singleleaf pinyon, Utah juniper (*Juniperus osteosperma*), sagebrush, and grasses. Pinyon/pinyon-juniper woodlands are found on 3.2 percent (537 acres) of the Clear Creek/Kings Canyon landscape analysis area (Table 4-1).

### **Shrubland and Other Land-Cover Types**

#### ***Sagebrush***

Species of sagebrush have adapted to varying soil types, topographical conditions, and both cold and dry environments. Major species types that occur in the sagebrush community include Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), big Great Basin sagebrush (*A. t.* ssp. *tridentata*), mountain big sagebrush (*A. t.* ssp. *vaseyana*), low sagebrush (*A. arbuscula*), black sagebrush (*A. arbuscula* ssp. *nova*), bud sage (*A. spinescens*), antelope bitterbrush (*Purshia tridentata*), ephedra (*Ephedra* spp.), desert peach (*Prunus andersonii*), rabbitbrush (*Chrysothamnus* spp.), spiny hopsage (*Grayia spinosa*), shadscale (*Atriplex confertifolia*), and a variety of perennial and annual grasses.

Sagebrush communities predominate in the lowest elevations, but they also occur at high elevations in the northeastern portion of Clear Creek and southeastern portion of Kings Canyon. In Voltaire Canyon, sagebrush is the dominant cover type, occupying more than 70 percent of the area. Twenty-six percent (4,390 acres) of the landscape analysis area is in sagebrush cover type (Table 4-1).

#### ***Bitterbrush***

Bitterbrush is a common associate of sagebrush and often dominates the upper elevations of the sagebrush zone (Charlet 1998). In the Clear Creek/Kings Canyon landscape analysis area, bitterbrush shrublands occur primarily on benchlands intermingled with the sagebrush cover type. Common associates of scrubland species include sagebrush, rabbitbrush, manzanita (*Arctostaphylos* spp.), and buckbrush (*Ceanothus* spp.). Sagebrush/bitterbrush cover type frequently intermingles with pinyon-juniper and Jeffrey pine/ponderosa pine vegetation types. Approximately 6.8 percent (1,151 acres) of the landscape analysis area consists of bitterbrush cover type (Table 4-1).

#### ***Mountain Shrub***

Extensive fields of mountain shrub cover type dominate the central portion of the Clear Creek/Kings Canyon landscape analysis area. The major plant community in the mountain shrub cover type is the chaparral shrub, which includes species such as manzanita, buckbrush, oak



(*Quercus* spp.), currant, and bitter cherry. Sagebrush and bitterbrush also occur in this montane shrub cover type. Approximately 17.6 percent (2,974 acres) of the Clear Creek/Kings Canyon landscape analysis area is in the mountain shrub cover type (Table 4-1).

### ***Low Elevation Riparian***

Riparian communities within the nonforest cover types are confined to narrow bands within the stream corridors, or wetlands, where moisture is adequate. Common riparian associates include poplar (*Populus* spp.), willow, cattails (*Typha* spp.), wildrose (*Rosa* spp.), gooseberry and currant, rushes (*Juncus* spp.), sedges (*Carex* spp.), and numerous grasses and forbs (USDI Bureau of Land Management 2001). Less than one percent (70 acres) of the Clear Creek/Kings Canyon landscape analysis area is in lowland riparian cover type (Table 4-1).

### ***Other Land-Cover Types***

Other land-cover types are a small component of the Clear Creek/Kings Canyon landscape analysis area. The combined total area, classified as urban, agriculture, barren land, and grassland, makes up less than five percent of the landscape analysis area (Table 4-1).

## **4.1.2 Conifer Encroachment in Riparian and Aspen Cover Types**

The exclusion of fires in the riparian and aspen communities in the Clear Creek/Kings Canyon landscape analysis area has caused the species composition to change. For example, conifers are encroaching upon aspen groves in some upslope areas in the Clear Creek/Kings Canyon landscape analysis area (USDA Forest Service 1993a). Aspen will regenerate from seed if environmental conditions are favorable, but it more readily regenerates through the sprouting of clones (DeByle and Winokur 1985). Fire stimulates resprouting and suckering of aspen clones, and subsequently reduces conifer encroachment. Without disturbance to stimulate aspen suckering and reduce conifer density, advanced conifer succession will reduce hardwood riparian and aspen communities over time (Bartos 2000).

Prior to Euro-American settlement, fire frequency in the aspen forest type is thought to have been very infrequent at high elevations (USDA Forest Service 1994b). At mid to low elevations, fire frequency in riparian vegetation likely reflected that of the adjacent vegetation cover type (USDA Forest Service 1994b).

## **4.1.3 Old Forest Structural Stage**

The definitions of old forest (or old-growth forest) vary significantly, and may be based on criteria such as advanced successional stage, tree size class, stand structure, or tree age. In the Sierra Nevada, a single operational definition does not capture the range of ecological conditions that represent old forests. Old forest conditions vary by forest types, ranging from open-canopied, alpine forests to close-canopied, mixed conifer forests (large trees with multi-strata or single-stratum structure) with snags and downed woody material.

An Old Forest Emphasis Area, a USFS-mapped land allocation, was identified for the HTNF based on existing old forest distribution and site capability (USDA Forest Service 2001b). Approximately 8.5 percent (1,437 acres) of the Clear Creek/Kings Canyon landscape analysis area is designated as Old Forest Emphasis Area. The designated Old Forest Emphasis Area is restricted to the upper elevations of the Clear Creek watershed (see Map 2-3).

In 1991 (USDA Forest Service 1991), the upper elevation of the Clear Creek watershed was inventoried for old-growth forest and selected forested vegetation was determined to meet the Toiyabe National Forest Plan (USDA Forest Service 1986) definition of old-growth forest. The existing old-growth forest in the Clear Creek watershed received only light intensity timber harvest during the Comstock era logging in the mid to late 1800s. The inventoried old growth mixed conifer forest type contains large Jeffrey pine, in excess of 40 inches diameter at breast height (dbh), on dry exposed sites. White fir trees in excess of 30 inches dbh are common in the area. Large-diameter red fir trees are found on the ridge tops. Western white pine stands, an uncommon occurrence in the Carson Front, are found in the uppermost portion of the Clear Creek watershed. Snags and downed woody material are abundant. Tree age classes in the old-growth forest are mixed. The presence of seeps and springs create unique riparian vegetation communities in the area. In 1993, approximately 300 acres of the old-growth forest located in the upper-third of the Clear Creek watershed were identified as a PAC for California spotted owl (USDA Forest Service 1993a).

The southern portion of the designated Old Forest Emphasis Area in the Clear Creek watershed was not part of the old-growth forest that was inventoried in 1991. A review of stand exam data shows Jeffrey pine, white fir, and red fir forest types, which originated in the late 1800s (post-Comstock logging), are located in the southern portion of the designated Old Forest Emphasis Area. Large trees (greater than 21 inches dbh) occur within these forested stands, and snags are abundant. Bark beetle-caused tree mortalities in the mid-1990s contributed to the decadence component in these stands.

#### **4.1.4 Forest Insects and Diseases**

During the 1860s through 1870s, the coniferous forests in the Clear Creek/Kings Canyon landscape analysis area were extensively logged, with the exception of inaccessible areas in the upper elevations of Clear Creek watershed, to support activities associated with the Comstock gold mining operations. Following the Comstock logging, the forests regenerated during a period of moist climatic conditions, sheep grazing, and fire suppression (USDA Forest Service 1993a). The resulting forest conditions tend to be relatively dense compared to historical forest conditions. In favorable site conditions, white fir was more abundant in both the forest understory and overstory. The change in forest composition and structure has likely increased the susceptibility to insect outbreaks and disease, particularly in times of low precipitation. The drought of the late 1980s to the mid-1990s increased insect infestations in the conifer forest types within the Clear Creek/Kings Canyon landscape analysis area.

The 1993 Spooner Environmental Assessment (USDA Forest Service 1993a) was performed to assess an area near Spooner Summit, located within the Clear Creek watershed. The assessment noted widespread white fir and red fir tree mortalities, caused by fir engraver beetles, which flourish in periods of drought in densely stocked, mixed conifer stands. The percentage of trees killed by fir engraver beetles (*Scolytus ventralis*) ranged from 15 to 55 percent of live trees; higher mortality rates were observed in small pockets of trees. Small pockets of trees killed by Jeffrey pine beetle (*Dendroctonus jeffreyi*) were also identified throughout the area. During this time, monitored pine beetle mortality centers were doubling or tripling in size annually. The 1994 East Shore Environmental Impact Statement (USDA Forest Service 1994b) was performed to assess an area west of the Clear Creek watershed. Jeffrey pine bark beetle mortality centers, estimated from less than an acre to three acres in size, were scattered throughout the stands. Certain areas were noted for beetle activity

decline, where stand density had been reduced by past tree mortality. Light mountain pine beetle (*Dentroctonus ponderosae*) mortality was observed in the lodgepole pine forest type.

Currently, insects and disease in the Clear Creek/Kings Canyon landscape analysis area are at endemic levels. The 2002 insect and disease aerial detection flight identified only one active insect or disease center in the landscape analysis area (USDA Forest Service 2002c). A small pocket of Jeffrey pine beetle-caused tree mortality (one to 15 trees) was mapped in the upper Clear Creek watershed along Highway 50. West of the landscape analysis area, along the east shore of Lake Tahoe, nine areas of Jeffrey pine beetle-caused tree mortality were mapped. The number of trees killed in these areas ranged from one to 15 trees up to 30 trees. The fir engraver beetle was noted as the mortality agent in one pocket, where 30 true fir trees were killed. The Jeffrey pine beetle was also active on private land, located south of the landscape analysis area, where approximately 100 trees were killed in four activity centers.

Dense stand conditions increase the risk of insect-related tree mortality in existing forest types, particularly during prolonged periods of drought. Stand density and host tree reductions during the insect outbreak in the 1990s may have reduced the extent of future outbreaks for some tree species. However, the 1993 Spooner Environmental Assessment predicted the likelihood of an additional bark beetle outbreak in five to 20 years, if forest stands remain overstocked.

The presence of dwarf mistletoe (*Arceuthobium campylopodium*) was recorded in the 1993 stand exam in the pine-dominated forest type located in the western portion of the Clear Creek watershed (USDA Forest Service 1993b). Bark beetle and mistletoe infestations were observed on private lands in the Clear Creek watershed (Dynamac Corporation 2003).

#### **4.1.5 Noxious Weeds and Undesirable Plants**

Noxious weeds alter the structure, organization, or function of ecological systems (Sheley and Petroff 1999). The 1974 Federal Noxious Weed Act defines noxious weed as follows:

“Noxious weed means any living stage, such as seeds and reproductive parts, of any parasitic or other plant of any kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interest of agriculture, including irrigation, or navigation or the fish or wildlife resources of the United States or the public health.”

The USFS Manual (USDA Forest Service 1995) further defines noxious weeds as:

“Those plant species designated as noxious weeds by the Secretary of Agriculture or by the responsible State official. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being native or new to or not common to the United States or parts thereof.”

The USFS weed management program may include treatment of undesirable plants. The USFS Manual (USDA Forest Service 1995) defines undesirable plants as:

“Plant species that are classified as undesirable, noxious, harmful, exotic, injurious, or poisonous pursuant to State or Federal laws. Species listed as threatened or endangered by the Secretary of the Interior according to the Endangered Species Act of 1973 are not classified as undesirable plants.”

In general, developed or disturbed areas in the Clear Creek/Kings Canyon landscape analysis area (e.g., roads and trails, dispersed camping sites, day use areas, riparian areas, and irrigation ditches) have a higher susceptibility to noxious weed infestations (E. Walker, personal communication 2003). These areas develop a seed bed that allows the establishment of noxious weeds (USDA Forest Service 2001b). Vehicular traffic (both on and off-road), watercourses, hikers, livestock, wildlife, and wind can contribute to the spread of noxious weed seeds.

The HTNF has conducted formal and informal field surveys for noxious weeds on National Forest System lands. Surveys for noxious weeds were completed primarily along roads and in other high-risk areas, such as day use and camping sites. The noxious weeds and undesirable plants known to exist in the Clear Creek/Kings Canyon landscape analysis area occur primarily in the central portion of Kings Canyon, along Kings Canyon Road. Similar noxious weed and undesirable plant populations also likely exist on disturbed private lands adjacent to the landscape analysis area (E. Walker, personal communication 2003). Cheatgrass was observed on private lands in the Clear Creek watershed (Dynamac Cooperation 2003).

In the Sierra Nevada Forest Plan Amendment, California Department of Food and Agriculture (CDFA) ratings for noxious weeds by treatment priority were used. The ratings reflect the present distribution, potential for eradication, and the significance of the pest in terms of potential economic and ecological damage. Table 4-2 lists known noxious weed occurrences in the Clear Creek/Kings Canyon landscape analysis area and associated CDFA ratings for the noxious weeds (CDFA Division of Plant Health and Pest Services 2003).

Undesirable plants known to occur on National Forest System lands in the Clear Creek/Kings Canyon landscape analysis area (mostly in the central portion of Kings Canyon) include chicory (*Cichorium intybus*), bull thistle (*Cirsium vulgare*), curly dock (*Rumex crispus*), and morning-glory (*Convolvulaceae* spp.).

Noxious weeds and undesirable plants on National Forest System lands located in the Kings Canyon area were treated in July 2003. These plants were treated with spot application of the herbicide Weedar 64. The treatment area was an irrigated pasture acquired by the USFS in 1995. Weeds treated in the area included musk thistle, Scotch thistle, curly dock, chicory, and St. Johnswort. Follow-up surveys and additional treatment, if needed, will occur in the 2004 field season (E. Walker, personal communication 2003).

**Table 4-2. Noxious Weeds Occurrence on National Forest System Lands in Clear Creek/Kings Canyon Landscape Analysis Area**

Noxious Weed		CDFA Rating
Common name	Scientific name	
Musk thistle	<i>Carduus nutrans</i>	A
Scotch thistle	<i>Onopordium acanthium</i>	A
Whitetop or Hoary Cress	<i>Cardaria draba</i>	B
Yellow starthistle	<i>Centaurea solstitialis</i>	C
Medusahead rye	<i>Taeniatherum canputmedusae</i>	C
St. Johnswort	<i>Hypericum perforatum</i>	C

Source: CDFA (California Department of Food and Agriculture) Division of Plant Health and Pest Prevention Services 2003; Humboldt-Toiyabe National Forest Noxious Weeds data; USDA Natural Resources Conservation Service 2002.

- A Weeds of known economic significance, targeted for eradication, quarantine, or containment efforts.
- B Weeds subject to eradication, containment, control, other holding action at the discretion of the local county agricultural commissioner.
- C Weeds associated with state- or county-funded eradication or containment efforts, except in nurseries or seed lots.

#### 4.1.6 Fire Regime Condition Classes

To address the impacts of past fire suppression activities and other factors on vegetation composition and structure, the USFS developed the Cohesive Strategy (USDA Forest Service 2002a). Fire regimes are used to characterize patterns of fire frequency, severity, size, and uniformity for vegetation types. The fire regimes that existed before 1860s (i.e., before Euro-American settlement) are referred to as the historical fire regimes.

Departures from historical fire regimes can increase the risk of loss of key ecosystem components (or resources at risk) and the risk to public safety. Changes in fire regimes resulting in increased risks are described as fire regime condition classes. The risk increases from condition class 1 (lowest risk) to condition class 3 (highest risk). Table 4-3 describes the fire regime condition classes used in the Clear Creek/Kings Canyon landscape analysis.

**Table 4-3. Descriptions of Fire Regime Condition Classes**

Condition Class	Departure from Historical Fire Regime	Description
1	None, Minimal, and Low	Vegetation composition, structure, and fuels are similar to those of the historical regime and do not predispose the system to risk of loss of key ecosystem components. Wildland fires are characteristic of the historical fire regime behavior, severity, and patterns.
2	Moderate	Vegetation composition, structure, and fuels have moderate departure from the historical regime and predispose the system to moderate risk of loss of key ecosystem components. Wildland fires are moderately uncharacteristic compared to the historical fire regime behaviors, severity, and patterns.
3	High	Vegetation composition, structure, and fuels have high departure from the historical regime and predispose the system to high risk of loss of key ecosystem components. Wildland fires are highly uncharacteristic compared to the historical fire regime behaviors, severity, and patterns.

Source: Hann and others 2003; USDA Forest Service 2002a.

Lightning- and American Indian-caused fires were common before European settlement of the area (Gruel 2001; Skinner and Chang 1996; USDA Forest Service 1997, 2001b) and were an integral part

of the terrestrial ecosystem. Since settlement of the area, fire suppression, moist climatic conditions, sheep grazing, and past logging have influenced the current vegetation conditions. The combined effect of these factors has changed the historical fire regimes in some vegetation types, particularly in pine-dominated forests. Table 4-4 shows the historical and current fire regimes and condition classes for major vegetation types in the Clear Creek/Kings Canyon landscape analysis area.

**Table 4-4. Historical and Current Fire Regimes and Condition Classes for Major Vegetation Types in Clear Creek/Kings Canyon Landscape Analysis Area**

Vegetation Type	Historical Fire Regime	Current Fire Regime	Current Condition Class
Sagebrush/ Bitterbrush	Frequent stand—replacement fire	Moderate interval—stand replacement fire	1
Mountain Shrub	Moderate interval—stand replacement fire	Moderate interval—stand replacement fire	1
Pinyon pine	Variable interval—mixed intensity fire	Moderate interval—mixed intensity fire	1
Jeffrey pine/ ponderosa pine	Frequent—low-intensity fire	Moderate interval—low to moderate intensity fire	1–2
Jeffrey pine/white fir	Frequent—low-intensity fire	Moderate interval—moderate to high intensity fire	2–3
Red fir/lodgepole pine/ whitebark pine	Variable interval—mixed intensity	Moderate interval—mixed intensity	1

The HTNF has kept wildfire records for the past 35 years (1968 through 2003). During that time, the majority of wildfires in the Clear Creek/Kings Canyon landscape analysis area has occurred in the sagebrush and bitterbrush communities. These fires have occurred primarily in the lower elevations of the Voltaire Canyon and Kings Canyon subareas. Sagebrush likely experienced historical stand replacement fires at return intervals of zero to 35 years, a pattern similar to that of the time period prior to Euro-American settlement (Hann and others 2003; USDA Forest Service 2001b). Areas of denser sagebrush occur within the landscape analysis area; however, the majority is in open cover that is within the range of historical fire occurrence (or condition class 1).

In pinyon pine/pinyon-juniper cover type, historical fire regimes are thought to have experienced patchy burns (Potter 1998). When favorable fire conditions occurred, areas of high stand density probably resulted in intense burning. In other areas, the lack of continuous fuels resulted in little damage to trees. Pinyon pine/pinyon-juniper cover types that occur in the Clear Creek/Kings Canyon landscape analysis area have canopy cover ranging between 10 and 60 percent. The current fire regime is expected to be similar to fires that burned historically; therefore, this cover type would be in condition class 1.

The large area of mountain shrub in the central portion of the Clear Creek/Kings Canyon landscape analysis area burned in the 1920s. This area probably once supported forest stands that were harvested during the Comstock era logging of the 1860s (R. Shaw, personal communication 2003). Fuel accumulations were likely quite high when the area burned, resulting in high fire intensity.

Historically, frequent low-intensity ground fires maintained open stands of Jeffrey pine, white fir, and red fir. Trees tended to occur in clumps, so the stands had discontinuous canopy. Large, old

trees were common. Frequent fires favored Jeffrey pine and ponderosa pine over white fir, especially at lower elevations (USDA Forest Service 1997). The historical fire return interval in pine-dominated stands was likely five to 20 years (Potter 1998). Historical fire return interval in white fir/Jeffrey pine forest type is estimated to be 20 to 50 years (USDA Forest Service 1997). Taylor (1998) found fire return intervals of 12 to 32 years in the drier sites of white fir/Jeffrey pine forests in the Lake Tahoe Basin, located west of the Clear Creek/Kings Canyon landscape analysis area. In Jeffrey pine/red fir forests, fire return intervals were nine to 47 years in sampled stands on the east-shore of Lake Tahoe. Jeffrey pine/white fir forest type experienced fire return intervals of nine to 47 years in sampled stands (Taylor 1998).

Fire suppression and favorable climatic conditions during stand establishment of the pine- and white fir-dominated mixed conifer forest types have led to high stocking levels, fuel accumulations, and a greater abundance of white fir. Most of these areas have not experienced wildfire in more than 100 years. On some sites that were historically maintained as more open pine-dominated stands, the density of trees has reached three to five times historical stocking levels (USDA Forest Service 1997). In some areas, mistletoe brooms increase ladder fuels. The insect-caused tree mortalities, associated with the drought in the late 1980s through the mid-1990s, have increased ground fuels accumulation. Where stand density and fuel loads are high, these stands would now support mixed-intensity or stand replacement fires and would be classified as condition class 2. In the high-value Old Forest Emphasis Area, located in the western portion of the Clear Creek watershed and where the risk of stand replacement fire exists, the fire regime condition class was adjusted to condition class 3.

Historically, higher elevation vegetation types experienced variable fire return intervals. These cover types include red fir, whitebark pine, and lodgepole pine. The resulting fires were generally slow-burning ground fires or infrequent stand replacement fires that burned in a mosaic pattern. Stand replacement fires consumed some areas, while other areas escaped. The extent and burn pattern in the forested vegetation reflect the cooler temperatures of the higher elevations, the patchy nature of the trees spacing within the forests, a fragmented landscape, and ground fuels that are packed by snow (Potter 1998; USDA Forest Service 1994b). In denser lodgepole pine stands, infrequent stand replacement fires may have occurred; however, these areas tended to be small because of the topographic influences of high elevation (Potter 1998). Estimates of historical fire return intervals for red fir forest is ten to 150 years (USDA Forest Service 1994b). The lodgepole pine forest is estimated to have historical fire return intervals between 25 to 150 years (USDA Forest Service 1994b). Because of the extended fire return intervals that occurred in these forest types, fire suppression has not likely affected the fire regimes in higher elevations. Current condition class in these higher elevation forest types is condition class 1.

#### **4.1.7 Wildfire Occurrence**

Fire history is closely related to vegetation and climatic pattern in forest ecosystems. Fire risk is defined as causes of fire ignitions, such as natural-caused (lightning strikes) or human-caused. Several large fires that have occurred on the Carson Ranger District were human-caused and burned during extreme fire weather conditions (R. Shaw, personal communication 2003). The available data show 13 fires have occurred in the Clear Creek/Kings Canyon landscape analysis area in the past 35 years (Table 4-5). Approximately 54 percent of the fires were human-caused and 23 percent were lightning-caused. No cause was listed for 23 percent of the wildfires.

**Table 4-5. Wildfire Occurrence in Clear Creek/Kings Canyon Landscape Analysis Area**

Year	Number of Fires	Fire Cause and Area Burned (acres)			Total Area Burned (acres)
		Lightning	Human	Unknown	
1968	2	0	841	0	841
1974	1	0	45	0	45
1976	1	0	20	0	20
1984	1	274	0	0	274
1988	3	1,521	0	1,518	3,039
1992	1	71	0	0	71
1998	1	0	0	32	32
2003	3	0	668	0	668
Total	13	1,866	1,574	1,550	4,990

Source: Humboldt-Toiyabe National Forest GIS data; R. Shaw, personal communication 2003. The 1974 wildfire is not shown on Map 4-2.

Eighty-eight percent of the area burned in wildfires that occurred within the Clear Creek/Kings Canyon landscape analysis area burned in the sagebrush, grassland, and bitterbrush cover types. The majority of the acres (74 percent) burned in the sagebrush cover type. These fires have primarily occurred in the lower elevations of Voltaire Canyon and Kings Canyon. Some areas have burned more than once. Only three percent of the forested vegetation (mostly Jeffrey pine and white fir forests) in the landscape analysis area has experienced wildfires during the past 35 years that records have been kept. Three percent of the area burned was in pinyon pine woodlands. Map 4-2 shows the locations of recorded fire occurrences since 1968 (with the exception of a wildfire in 1974).

#### 4.1.8 Landscape Condition and Potential Fire Behavior

The prediction of fire behavior is valuable for assessing potential fire damage to resources, for fire suppression planning, and for fuels treatment planning. Fire behavior is a function of topography (e.g., elevation, slope, and aspect), weather, and vegetation/fuel characteristics (e.g., vegetation-fuel types, canopy closure, stand structure, and fuel moisture contents).

Elevation affects the microclimate of an area (NWCG 2001), which subsequently affects the vegetation composition and distribution of an area. High elevations have a shorter fire season because there are fewer continuous fuels that would carry fire. Snow also lingers in higher elevations because of the lower temperatures. Conversely, lower elevations have a longer fire season because fuels tend to become drier sooner over a longer, hotter dry season. As a result, fire behavior in lower elevations tends to be more intense.

Slope gradient also affects fire behavior. If a fire is burning upslope, for example, the flames are closer to the fuels ahead of the fire. The steeper the slope, the quicker the fuels are preheated as the fire moves uphill. The relationship between slope aspect and fire behavior is based on solar heating and distribution of vegetation types. South and west aspects receive more solar heating than north- and east-facing slopes, so the existing fire fuels are drier (NWCG 2001), although the vegetation on south-facing slopes tends to be sparser than on other aspects. Table 4-6 shows the distribution of aspects in the Clear Creek/Kings Canyon landscape analysis area. South- and east-facing slopes predominate, covering 31.7 percent and 36.8 percent of the landscape analysis area, respectively.



**Table 4-6. Slope Aspects in the Clear Creek/Kings Canyon Landscape Analysis Area**

Aspect	Clear Creek		Kings Canyon		Voltaire Canyon		Landscape Analysis Area	
	Area (acres)	Extent (% TA)	Area (acres)	Extent (% TA)	Area (acres)	Extent (% TA)	Area (acres)	Extent (% TA)
East	3,194	31.2	2,063	49.5	940	38.2	6,197	36.8
Flat	14	0.1	4	<0.1	0.4	<0.1	19	0.1
North	1,819	17.8	1,233	29.6	651	26.4	3,702	22.0
South	3,928	38.4	657	15.8	755	30.7	5,339	31.7
West	1,280	12.5	209	5.0	115	4.7	1,603	9.5
Total	10,235	100.0	4,165	100.0	2,461	100.0	16,861	100.0

TA = Total area

Source: USGS 10-meter digital elevation model-based terrain analysis.

Map 4-3 illustrates the distribution of slope aspects in the Clear Creek/Kings Canyon landscape analysis area.

Wind direction drives the fire spread (Rothermel 1983). The stronger the wind, the faster the fire spread. Winds in the Clear Creek/Kings Canyon landscape analysis area are variable. Strong downslope winds off the Carson Range occur primarily in the afternoon and evening hours. During these winds, wildfires burn downhill in an easterly to northeasterly direction. During the day, when upslope winds prevail, fires tend to burn upslope. Occasionally, southeast winds prevail, causing wildfires to burn sideslope.

Fire fuel models describe potential fire intensity based on existing surface vegetation-fuel classes. Table 4-7 shows the crosswalk between fuel models and vegetation cover types for vegetation-fuel classes applicable to the Clear Creek/Kings Canyon landscape analysis area. The vegetation types listed in this table are similar to those described in Table 4-1. The definitions of fuel models are based on Albini (1976), and the criteria for choosing the fuel model are based on Anderson (1982). Map 4-2 displays the distribution of the vegetation-fuel classes for the Clear Creek/Kings Canyon landscape analysis area.

Predictions of crowning fire behavior are related to stand structure and canopy closure. The presence of ladder fuels that would allow fire to reach the tree crowns is indicated by tree height, crown base height, and crown density. The probability of crown fires for the Clear Creek/Kings Canyon landscape analysis area cannot be characterized because a comprehensive vegetation structure classification and mapping are not available.

**4.1.9 Urban Wildland Intermix Zone and Wildfire Fuels Hazard**

The urban wildland intermix zone is where developed areas, such as homes, ranches, and farms, are located in or near wildlands. In the wildland interface development, the risk of wildfires threatens life and property. Population growth in the Carson City area is expected to increase nearly 26 percent over the next 20 years. Development within the wildland interface is expected to increase based on the human population projection. In the 2002 multi-agency Sierra Front Strategic Fuels Planning Workshop, hosted by the HTNF, Clear Creek watershed was classified as an area with moderate housing development that is expected to increase in the next five to 10 years (USDA Forest Service 2002b).

**Table 4-7. Fuel Models and Vegetation Types Crosswalk for Vegetation-Fuel Classes Applicable to Clear Creek/Kings Canyon Landscape Analysis Area**

Fuel Model	Vegetation Type
Fuel Model 1—Short grass	Grassland; Salt desert scrub.
Fuel Model 2—Timber (grass and understory)	Jeffrey pine/ponderosa pine (<30% crown cover); Lodgepole pine (<60% crown cover); Lowland riparian; Mountain riparian; Sagebrush/perennial grass.
Fuel Model 4—Chaparral (6 feet)	Aspen; Pinyon-juniper (30–60% crown cover); Jeffrey pine/ponderosa pine/mountain shrub; Bitterbrush; Mountain shrub.
Fuel Model 6—Dormant (shrub and hardwood)	Pinyon-juniper (<30% crown cover); Pinyon (<30% crown cover); Jeffrey pine/ponderosa pine (30–60% crown cover); Mountain sagebrush; Sagebrush.
Fuel Model 8—Closed timber litter	Pinyon (30-60% crown cover); Lodgepole pine (30-60% crown cover); Lodgepole pine (>59% crown cover); Red fir (30-60% crown cover); Whitebark pine (<30% crown cover); Jeffrey pine/ponderosa pine (>59% crown cover).
Fuel Model 10—Conifer (litter and understory)	Red fir (>59% crown cover); White fir (>59% crown cover).
Fuel Model 99—Miscellaneous	Agriculture; Urban; Barren.

Source: Anderson 1982; Nevada GAP Data 1996; R. Shaw, personal communication 2003.

Urban interface areas are defined as settlements with housing densities of 16 or more houses per square mile (one structure per 40 acres). In these areas, human habitation is mixed with areas of flammable vegetation. Intermix zones identify where fuels treatment would be focused to reduce fire risk to property, and reflect the degree of fuel treatments that would be applied in these zones. Zone width is based on likely rates of fire spread combined with assurance of protection. The inner fire defense zone extends 0.25 miles around the developed property. Treatment within this zone is dependent on site conditions. The fire threat zone is a 1.25-mile-wide buffer immediately beyond the inner defense zone (USDA Forest Service 2001a, b). Treatment in the threat zone is designed to reduce fire intensity and rate of spread as it approaches the inner defense zone (USDA Forest Service 2001a). Table 4-8 and Map 2-3 show the distribution of urban wildland intermix defense and threat zones within the Clear Creek/Kings Canyon landscape analysis area. Approximately 31.9 percent (5,376 acres) of the landscape analysis area is identified as urban wildland intermix threat zone. The majority of the threat zone (5,001 acres) occurs within the Clear Creek watershed. Approximately 23.1 percent (3,896 acres) of the landscape analysis area is identified as urban wildland intermix defense zone. The defense zone is located primarily in Clear Creek (1,249 acres) and Voltaire Canyon (1,440 acres).

### ***Fire Safe Communities and Hazard Mitigation Strategies***

The fire management strategy for the urban wildland intermix zone recognizes that achieving successful outcomes will depend on landowners' cooperation to take steps to reduce hazardous fuels on their properties. The Nevada Fire Safe Council (NFSC) is an organization that aids property owners in an effort to reduce fire hazard/risk. NFSC, which was founded in 2000, operates through local community chapters. A chapter was formed in the Clear Creek watershed, where developed

**Table 4-8. Urban Wildland Intermix Defense and Threat Zones in the Clear Creek/Kings Canyon Landscape Analysis Area**

Urban Wildland Intermix Zone	Clear Creek		Kings Canyon		Voltaire Canyon		Landscape Analysis Area	
	Area (acres)	Extent (% TA)	Area (acres)	Extent (% TA)	Area (acres)	Extent (% TA)	Area (acres)	Extent (% TA)
Defense	1,249	12.2	1,207	29.0	1,440	58.5	3,896	23.1
Threat <sup>1</sup>	5,001	48.9	375	9.0	0	0	5,376	31.9
Total	6,250	61.1	1,582	38.0	1,440	58.5	9,272	55.0

TA = Total area

Source: Humboldt Toiyabe National Forest GIS data.

properties were identified as “community at risk”. Within the Clear Creek chapter of NFSC, 27 of 54 privately owned land parcels were developed properties in 2003.

In the *Wildfire Risk/Hazard Assessment and Risk Mitigation Plan* (Dynamac Corporation 2003), wildfire risks and hazards to private lands and structures in Clear Creek were identified. Based on the assessment, it was determined that the greatest risk to Clear Creek homeowners is from fire pushed eastward into the Clear Creek valley by strong downslope winds off the Carson Range. The western portion of the wildfire risk assessment area (within the study area and around its perimeter) has heavy accumulations of forest biomass, including areas of Jeffrey pine with nearly closed canopy and mixed forest/brush lands.

The mitigation actions proposed for the Clear Creek assessment area in the risk/hazard assessment, in order of priority, were the following:

1. Establish firebreak/shaded fuelbreak at the western end of Clear Creek assessment area;
2. Fuel reduction on south side of Highway 50 right-of way;
3. Reduce fuels around existing homes;
4. Establish firebreak between Sections 34 and 35;
5. Develop water storage facilities; and
6. Establish shaded fuelbreak south of Clear Creek in T14N, R19E, Section 2.

Members of the Clear Creek chapter of NFSC have used the proposed mitigation actions to focus on improvements that will reduce the wildlife risk around private properties. Trees near structures have been cut and removed, one resident installed a 30,000-gallon cistern, and other residents are planning to install two additional cisterns. The next phase of improvement calls for the landowners to remove brush from their property and seed the cleared areas with crested wheat to discourage the establishment of highly flammable cheatgrass (S. Arnold, personal communication 2003). West of the Clear Creek valley development, a landowner has created a firebreak around the perimeter of his 50-acre ranch and maintains a portion of his property as an irrigated meadow. In addition, he has

plans to develop facilities around his existing pond to accommodate helicopter bucket filling to fight wildfires in 2004 (J. Alexander, personal communication 2003).

The wildfire risk/hazard assessment for Clear Creek notes that there has been some pruning and construction of firebreaks on nearby Tribal lands. Crews who are being trained to fight fires have done most of this work. Currently, there are plans to build a golf course and houses on the privately owned Schneider Ranch property, in the south-central portion of the Clear Creek watershed. Fire risk associated with this new development would be assessed once design and construction are finished.

Accessibility of an area is an important component of fuels treatment and fire suppression. For National Forest System lands in the Clear Creek/Kings Canyon landscape analysis area, road density is moderately high—an average density of 2.4 miles per square mile (not including motorized [unimproved four-wheel drive, 4WD] or non-motorized trails) (see Table 4-14). U.S. Highway 50 bisects the landscape analysis area. In Clear Creek, roading is more extensive on private lands. Clear Creek Road (Old Highway 50) is the primary access to National Forest System lands. Portions of the old highway roadbed are in disrepair, which may limit some vehicular access, such as large fire engines. The Kings Canyon area and the northwestern portion of the Clear Creek area are accessed primarily by a single road system, the Kings Canyon Road. Road density is highest in Voltaire Canyon (see Table 4-14), although road conditions are sometimes steep and narrow.

## **4.2 Recreation Opportunities**

There are a variety of managed recreation opportunities within the Clear Creek/Kings Canyon landscape analysis area. The opportunities, according to the Recreation Opportunity Spectrum (ROS) designations adopted in the 1986 Toiyabe National Forest Plan (USDA Forest Service 1986), include Semi-Primitive Non-Motorized, Semi-Primitive Motorized, and Roded Natural (see Appendix D for ROS definitions).

### **4.2.1 Roads and Trails Access**

The Clear Creek/Kings Canyon landscape analysis area is a conduit for residents in the urban area of Carson City to access recreation opportunities in the HTNF and to approach the Lake Tahoe area. Access into and through the analysis area is provided by a wide variety of road system and some official USFS trails.

Highway 50 is the primary road through the landscape analysis area. It connects Carson City to the eastern shore of Lake Tahoe and to communities near the lakefront. According to the HTNF GIS data, of the 81.4 miles of roads and trails within the landscape analysis area, 47 percent (38.4 miles) are unimproved roads. Most of the unimproved roads, totaling 24.7 miles, within the analysis area are located on non-National Forest System lands. Table 4-9 shows the lengths of roads and trails on National Forest System lands and other lands in the Clear Creek/Kings Canyon landscape analysis area. Map 4-4 shows the locations of roads and trails in the landscape analysis area.

The National Forest System lands in the Clear Creek/Kings Canyon landscape analysis area contain about twice the length of motorized (4WD) trails as non-motorized trails. Voltaire Canyon has the highest concentration of National Forest System motorized trails, totaling 4.4 miles within 2,462

**Table 4-9. Road and Trail Lengths by Land Ownership in Clear Creek/Kings Canyon Landscape Analysis Area**

Land Ownership	Lengths (miles)				
	Paved Road	Dirt Road	Unimproved Road	Trails (4WD)	Trails (non-motorized)
National Forest System	4.5	6.1	13.6	8.8	4.1
Others	9.7	4.4	24.7	1.5	3.8
Total	14.3	10.5	38.4	10.3	7.9

Road/Trail Types: Paved= Primary Highway (1) and Improved, Paved (3); Dirt= Improved, Dirt (5) and Unimproved (6); Trails (4WD)= Unimproved, 4WD and Trails (non-motorized).

acres. Kings Canyon provides a comparable amount of 4WD trail access. National Forest System lands in the Clear Creek Canyon contain about 0.5 miles of 4WD-accessible trails.

The Clear Creek/Kings Canyon landscape analysis area has 7.9 miles of non-motorized trails, including segments of the Tahoe Rim trail. The length of the non-motorized trails is similar between the National Forest System lands and other lands, with 4.1 miles under the management of the National Forest System. The small network of non-motorized trails is concentrated in two locations within the landscape analysis area. The first cluster of non-motorized trails is located north of Kings Canyon Road in the northeast part of Kings Canyon. These non-motorized trails connect to motorized trails within Kings Canyon and non-motorized trails north of the analysis area in Ash Canyon. The second cluster of non-motorized trails is located along the western boundary of the analysis area in the Clear Creek watershed. These trails are located near the Tahoe Rim Trail, which runs north-south through Clear Creek.

The Travel Management Map for HTNF (USDA Forest Service 1994c) shows the roads that are open for public use. According to the Travel Management Map, most of Kings Canyon Road is not suitable for passenger cars, and the Clear Creek Road is improved east of the Clear Creek Conservation Center and available for 4WD use west of the Conservation Center.

**4.2.2 Off-Highway Vehicles**

Almost all of the roads and trails in the Clear Creek/Kings Canyon landscape analysis area are open to OHV use, with the exception of a few trail segments and U.S. Highway 50. As addressed in the previous section, OHV use of 4WD trails is concentrated in the Voltaire Canyon area. However, OHVs can access the remaining improved and unimproved roads within the analysis area.

Estimated OHV visitor use in Voltaire Canyon is approximately five to 10 people a day. Night use in Voltaire Canyon is popular, typically beginning after 5:00 p.m. (L. Anderson, personal communications 2003). The vegetation and soils in Voltaire Canyon are easily disturbed by motorized use, and resource damage has occurred within the canyon in areas where OHV users travel off the designated routes. The “pioneered” OHV trails also alter the scenic integrity of the analysis area. This effect is especially apparent when viewed from Carson City. After the 2003 wildfire in Voltaire Canyon, OHV users entered and further disturbed the burned area.

**4.2.3 Developed Campground and Dispersed Camping**

No developed camping facilities exist in the Clear Creek/Kings Canyon landscape analysis area; as a result dispersed camping is encouraged. Dispersed camping is an attractive recreation opportunity in

the landscape analysis area. Dispersed camping typically occurs near existing roads, trails, and areas with scenic overlooks, but there are no specific Carson Ranger District user data that can be reported for this activity.

Dispersed campers in the analysis area must comply with the following USFS rules: limit stays to five days, obtain a fire permit, camp 100 feet from any water source, pack out trash, and bury human waste at least six inches below ground surface.

#### **4.2.4 Day Use Area**

The Spooner Summit day use area is located within the western part of the Clear Creek/Kings Canyon landscape analysis area, just south of U.S. Highway 50 in Clear Creek Canyon (Map 4-4). Trailheads for the Tahoe Rim Trail and the Kingsbury Grade Trail are located near this day use area, which includes a picnic area and a newly constructed permanent vault toilet. OHV use is evident on the unimproved road just east of the site. The outfitter/guide operation using the area for snowmobiling contributes to the maintenance of the unimproved road. Wood planks were established over culverts to help stabilize runoff in the area. Planned improvements for the area are limited to repaving the parking area.

#### **4.2.5 Hiking and Biking**

Any road or trail on National Forest System lands in the Clear Creek/Kings Canyon landscape analysis area is available for hiking and biking. The most recognized non-motorized trail in the analysis area is the Tahoe Rim Trail, which travels through Spooner Summit. From the Spooner Summit trailheads north and south of U.S. Highway 50, hikers and bikers on the Tahoe Rim Trail can access Tahoe Meadows trailhead to the north and Kingsbury Grade trailhead to the south.

Other popular areas for hiking and biking are the Kings Canyon Road and the Clear Creek Road (Old Highway 50) (P. Hardy, personal communication 2003). Both of these east-west roads provide the residents of Carson City access into the National Forest System lands. Only partial segments of the Kings Canyon Road and Clear Creek Road are within National Forest System lands; the remaining segments cross state or privately owned lands. Voltaire Canyon is also a popular place for hiking and jogging on a network of system and non-system trails. Recreationists enjoy easy access to these trails from the urban developments in Carson City.

Motorized uses, mostly off-road vehicles, take place in the Clear Creek and Kings Canyon areas, but not as often as pedestrian/equestrian, or bicyclist use. At Clear Creek, there is no developed facility for day use parking. It is a popular area because the slopes are moderate and provide frequent hikers and bicyclists with the opportunity to enjoy the forest and its surrounding environment. At Kings Canyon, a paved terminus is used as a turn-around and parking. The site is posted with information about the use and limited facilities in the area. This place is popular with hikers who frequent the short trail to the waterfall or the Borda Meadow. Cyclists normally continue up the unpaved portion of Kings Canyon Road. The more ambitious riders continue six miles uphill to the Spooner Pass day-use facility. Another popular activity for bicyclists is to ride down from the Spooner Summit day-use facility to the edge of the paved section of Kings Canyon Road or the edge of the valley floor (J. Guzman, personal communication 2003). Hikers, cyclists, and equestrians must cross the heavily traveled U.S. Highway 50 to travel from the Spooner Summit day use area to Kings Canyon Road. Highway 50 has no crosswalk or device to notify drivers of pedestrians using the area.

#### **4.2.6 Winter Recreation**

Dispersed winter recreation activities, such as snowshoeing and cross-country skiing, may occur throughout the Clear Creek/Kings Canyon landscape analysis area. The Carson Ranger District issues an outfitter/guide permit to Zephyr Cove Snowmobiles for snowmobile tours from November to March each year. Zephyr Cove uses the parking area and toilet and the Spooner Summit day use area. Snowmobile use in the area averages 2,933 recreation visitor days a year (C. Burke, personal communication 2003). The tours begin at the Spooner Summit trailhead and travel south on trails groomed by the tour guides. Most of the trails used for the tour run are located outside of the landscape analysis area. The USFS is working with Zephyr Cove to maintain stewardship of the permanent toilet facility at Spooner Summit (P. Hardy, personal communication 2003).

Winter recreation use in the Kings Canyon consists of cross-country skiing and snowmobiling, when snow conditions are compatible. A popular staging/parking area for winter users in the northern part of the landscape analysis area is at Kings Canyon Road, near the rural subdivision located about 0.5 mile west of Carson City.

#### **4.2.7 Scenic Viewpoints and Special Historic Places**

The topography in the Clear Creek/Kings Canyon landscape analysis area offers sweeping views of the Carson Range and Carson City to the east for visitors traveling along U.S. Highway 50. A designated scenic viewpoint is located within the analysis area along eastbound U.S. Highway 50. Another scenic viewpoint is the waterfall that is located near the rural subdivision located about 0.5 mile into the analysis area, traveling west on Kings Canyon Road. At higher elevations in the more remote areas, recreationists can also take in views of Lake Tahoe.

A cultural experience associated with the analysis area is Kings Canyon Road, which is listed on the National Historic Register. The stonework along this road is of special significance.

#### **4.2.8 Other Recreational Activities**

Although other locations within the HTNF receive more hunters and anglers, the Clear Creek/Kings Canyon landscape analysis area does attract some of these recreation users. The analysis area also attracts groups who participate in hangliding. Scenic viewing of the Carson Front topography is popular along U.S. Highway 50.

#### **4.2.9 Links to Other Recreation Facilities**

Agencies managing the land adjacent to the Clear Creek/Kings Canyon landscape analysis area plan to link recreation systems throughout the Carson Front. Carson City adopted a plan for the Eagle Valley Trail System in 1995 (Carson City Parks and Recreation Department 1995). This trail system, planned for hiking, biking, mountain biking, and equestrian use, has seven segments and additional trail loops. Three of the trail segments would be positioned for easy access into the National Forest System lands:

- Segment 1— V&T Railroad West, connecting the northern part of Highway 395 with Kings Canyon Road;

- Segment 2— C Hill, connecting Kings Canyon Road to the Carson Ranger District office along an existing fire road at the base of C Hill; and
- Segment 3— Carson Range/Voltaire Canyon, from the Carson Ranger District office to Highway 395 at U.S. Highway 50.

A few trail loops and staging areas for recreationists are planned near the National Forest System lands. The staging areas would have parking, water, and other facilities and could serve as a base for people enjoying recreation opportunities associated with Carson City or National Forest System lands. The Carson City Bike Route Map identifies both Kings Canyon Road and Old Clear Creek Road as an alternate bike route or a touring route.

Douglas County, which includes the southern portion of the Clear Creek/Kings Canyon landscape analysis area, released a County Comprehensive Trails Plan in 2003. Maps in the plan show the network of planned recreation facilities throughout the county. There is one proposed high-priority on-street trail within the landscape analysis area, located on Old Clear Creek Road near the Nevada State (Clear Creek) Youth Camp. Douglas County also proposed an off-street trail within the Clear Creek/Kings Canyon landscape analysis area that would link the Spooner Summit day use area with a trail directly to the east in Jacks Valley. Also, development of a golf-course residential community south of Clear Creek is proposed in Douglas County. Developers of the proposed golf course and housing project have expressed interest in funding a trailhead with parking for non-motorized activities on the western segment of Old Clear Creek Road in the landscape analysis area (D. Miner, personal communication 2003).

Other potential recreation opportunities adjacent to National Forest System land are associated with urban residential development in Carson City. A public access right-of-way exists south of Kings Canyon Road on a cul-de-sac residential street. The only parking available adjacent to the right-of-way is on-street parking. North of this right-of-way, parallel to Kings Canyon Road, is a non-motorized Carson City trail. This trail links to Voltaire Canyon Road within the Clear Creek/Kings Canyon landscape analysis area. Also in Carson City, a development is proposed, although not approved, for the area north of the Carson Indian Colony and west of Curry. One current design strategy includes the reservation of open space in the valley adjacent to National Forest System lands. This reserve may be a condition of city approval for the development (J. Guzman, personal communication 2003).

The Clear Creek/Kings Canyon landscape analysis area is also part of regional recreational planning. One of these opportunities is the planned “Capital to Capital Trail”. This trail would connect Sacramento, California, to Lake Tahoe and the Tahoe Rim Trail and terminate in Carson City, Nevada (Placer County 2002). The trail will generally allow pedestrians, equestrians, and bicyclists. Within the state of Nevada, the trail is anticipated to use the existing Tahoe Rim Trail up to the vicinity of Spooner Summit. At that point, the trail will continue east on the Kings Canyon Road (also known historically as the Lincoln Highway) within the landscape analysis area. The trail project is envisioned as a multiple state and agency effort involving cities, counties, and private organizations and individuals (J. Guzman, personal communication 2003).

The Humboldt-Toiyabe National Forest and the Carson City Open Space Program are working towards creating recreation opportunities in this region as a result of the Southern Nevada Public



Land Management Act of 1998. This bill authorizes the sale of environmentally sensitive lands under federal jurisdiction in Clark County, Nevada. The proceeds of those sales are used to fund several programs, including the acquisition of environmentally sensitive lands. The USFS's Carson Ranger District office, in partnership with the Carson City Open Space Program, has been successful in obtaining approval from the Secretary of the Interior for purchase of the following parcels:

- Approximately 140 acres (formerly the Steidley parcels) located within the Clear Creek watershed. The resource values for these parcels are riparian habitat, sensitive species and potential recreation opportunities.
- The Carson City Open Space Program purchased a 40-acre parcel almost completely surrounded by National Forest System lands in Kings Canyon. This parcel is part of the Borda Meadow, which the USFS manages. Resource values of this parcel include riparian habitat, sensitive species, recreational potential, and scenic integrity.
- Approximately 320 acres located mostly on the northern section of Kings Canyon Road. These parcels are partially surrounded by National Forest System lands and exhibit resource values for sensitive species, wildlife habitat, and scenic integrity.

State of Nevada funds are also available through a statewide ballot initiative, approved by the voters in November 2002, for the purchase of environmentally sensitive lands (J. Guzman, personal communication 2003).

### **4.3 Scenery/Visuals**

Visual quality is a key natural resource for the Carson Front Management Area (USDA Forest Service 1986). As a regional trade and retail center, the visual quality of the landscape observed from Carson City is a major attraction for visitors, residents, and employers. For those traveling eastbound on U.S. Highway 50 from California, this stretch of highway offers the first views of the eastern slope of the Sierra Nevada. Conversely, the westbound highway offers the first views of Lake Tahoe.

The adopted Visual Quality Objectives (VQOs) for the Clear Creek/Kings Canyon landscape analysis area are Modification, Partial Retention, and Retention. Management direction in the 1986 Toiyabe National Forest Plan specifies that Retention VQOs should be met along U.S. Highway 50. Map 4-5 shows the VQOs within the landscape analysis area (based on the HTNF GIS layer), and Appendix E provides the definitions of each VQO.

#### **4.3.1 Clear Creek**

A little more than 50 percent of the Clear Creek subarea is within National Forest System lands. Coniferous forest dominates the vegetation cover in this watershed. Sweeping views of the Carson Range are visible from U.S. Highway 50, which runs east-west through the watershed. Users accessing the trail that runs south from Spooner Summit gain majestic views of the Lake Tahoe Basin.

Approximately 57 percent of the National Forest System lands in this watershed has minimal landscape variety, with continuous vegetative cover classified as Variety Class Type C.

Approximately 38 percent of the National Forest System lands are classified as Variety Class Type B. Variety Class Type B suggests a landscape common for the area, where the vegetation cover is contiguous, but other patterns are interspersed in the landscape. The remaining five percent is classified as Variety Class Type A, which is distinctive (i.e., having unusual or outstanding features for the landscape).

### **4.3.2 Voltaire Canyon**

Voltaire Canyon contains about 80 percent by National Forest System lands. The landscape of Voltaire Canyon includes sagebrush communities on rolling hills. This vegetation cover type is typical of lower elevations in the eastern part of the Carson Range. From Voltaire Canyon, visitors have a view of Carson City. Key viewing areas in the Voltaire Canyon are from the OHV roads in the area.

Most of the landscape in Voltaire Canyon (56 percent of National Forest System lands) has minimal landscape variety consisting of continuous sagebrush shrublands, which is classified as Variety Class C. The remaining 44 percent of National Forest System lands in Voltaire Canyon are classified as Variety Class B, which indicates a landscape common for the area.

### **4.3.3 Kings Canyon**

Approximately 63 percent of Kings Canyon area is in National Forest System lands. The landscape character in Kings Canyon is similar to the Clear Creek watershed. Kings Canyon Road is the key viewing area in Kings Canyon

Approximately 95 percent of the Kings Canyon subarea is in landscape common for the area, where the vegetation cover is contiguous, but other patterns are interspersed in the landscape. This type of landscape is classified as Variety Class B. The remaining five percent of the landscape is classified as Variety Class C, with minimal landscape variety.

## **4.4 Wildlife**

This section addresses selected focal species and associated habitats as well as key threats or risk factors to habitats or populations at the landscape scale. Descriptions of vegetation zones, composition, and distribution were described in Section 4.1.1.

### **4.4.1 Sagebrush/Bitterbrush Habitat Associated Species**

#### **Mule Deer and Species-Habitat Relationships**

Mule deer are common, yearlong resident of the Carson Range and Clear Creek/Kings Canyon landscape analysis area. Seasonal movements, following the snowline, from higher elevations in the summer to lower elevations in the winter are common. Mule deer, a multi-habitat species, generally occur in early to intermediate succesional stages of most forests (commonly in open forests and forest edges), woodlands (e.g., pinyon-juniper), and shrublands (e.g., sagebrush and bitterbrush) (UNR 2003b; NDOW 2003). Mule deer are primarily browsers and prefer to forage on the new growth of shrubs. In addition, they feed on forbes and grasses in grasslands. Mule deer feeding behavior is quite variable in any given location (UNR 2003; NDOW 2003b).

Mule deer and sage grouse (*Centrocercus urophasianus*) are sagebrush community-related species that are in decline in the western United States. Areas with sagebrush and bitterbrush provide preferred

suitable habitat for mule deer, especially in their winter range (NDOW 2003). Sagebrush and bitterbrush provide woody browse species in the mid- to lower elevations within the Clear Creek/Kings Canyon landscape analysis area. Sagebrush and bitterbrush occur within pinyon-juniper woodland, montane forest, and montane shrub cover types in middle to higher elevations. Big sagebrush and antelope bitterbrush are preferred browse species for mule deer due to their palatability (Tweit and Houston 1980 in USDA Forest 2004a; Gullion 1964 in USDA Forest Service 2004b).

### **Habitat Status and Population Trend**

Sagebrush and sagebrush/perennial grass vegetation types cover 24.2 percent (4,090 acres) of the Clear Creek/Kings Canyon landscape analysis area (Table 4-1 and Map 4-1). Sagebrush scrub habitat in the landscape analysis area is distributed as follows: 1,509 acres (14.8 percent) of Clear Creek, 837 acres (20.1 percent) of Kings Canyon, and 1,744 acres (70.8 percent) of Voltaire Canyon. In the landscape analysis area, sagebrush community predominates in the lowest elevations, mostly in Voltaire Canyon. Sagebrush occurs in upper elevations in the northeastern portion of Clear Creek and the southeastern portion of Kings Canyon. Bitterbrush is a common associate of sagebrush scrub and often dominates the upper elevations. Approximately 6.8 percent (1,151 acres) of the Clear Creek/Kings Canyon landscape analysis area consists of bitterbrush cover type; 45.8 percent of the total extent occurs at mid-elevations within the Clear Creek area (Table 4-1 and Map 4-1).

In the Clear Creek/Kings Canyon landscape analysis area, mule deer have summer range in mid-elevation habitats of mostly montane forest types and winter range in lower elevation habitats of mostly pinyon-juniper woodlands and sagebrush scrub. The U.S. Highway 50 corridor and some areas of Voltaire Canyon constitute areas with marginal suitable habitat for mule deer. Winter concentration areas for mule deer include lower elevations of the Clear Creek area, below Genoa Peak and Spooner Summit, and west of the Jacks Valley Wildlife Management Area (located south of the landscape analysis area).

Mule deer population surveys are not available for the Clear Creek/Kings Canyon landscape analysis area. However, mule deer counts by the Nevada Division of Wildlife (NDOW) are available for Management Unit 192, which overlaps the landscape analysis area, within the Carson Range. The NDOW completes single-pass, aerial surveys annually during fall and spring seasons to estimate relative abundance and herd composition of mule deer.

Figures 4-1 and 4-2 show the trends in the relative abundance and herd composition (sex and age ratios) of mule deer, respectively, based on fall census data for Management Unit 192 between 1961 and 2002. As shown in Figure 4-1, the relative abundance of mule deer fluctuated between years, with the highest number of animals (1,039, of which 69 were bucks, 641 were does, and 329 were fawns) observed in 1981. Since 1997, the relative abundance of mule deer has shown a constant downward trend and dropped below historical low levels in 2001 (124 total animals) and 2002 (84 total animals).

Herd composition refers to the ratio of bucks, does, and fawns in the population. Herd composition changes within and between years due to influences of reproduction, mortality (e.g., diseases, accidents, and predation), hunting pressure, range conditions and land use, and other environmental factors such as precipitation, temperature, drought, or floods. Since 1987, the buck-to-doe ratios

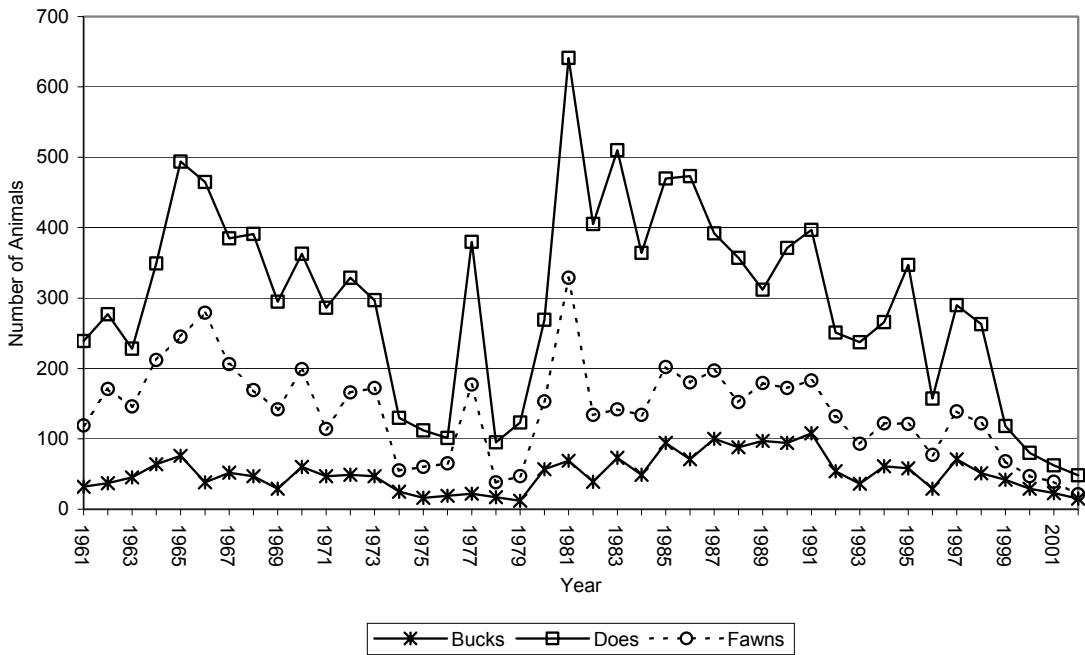
remained moderately high, with a peak observed in 2001 (37 bucks/100 does or 2.7 does per buck), for Management Unit 192 (Figure 4-2). A high volume of does (a wide ratio of does per buck resulting in a surplus of does) can result in a rapid increase of deer numbers and may be followed by a die-off when conditions deteriorate with drought or severe winter. The ratio of fawns per 100 does is an index of annual fawn population and recruitment (young successfully added to the deer herd) to the next age class. Fawn-to-doe ratios demonstrated significant fluctuations between years, with the highest ratios in 1963 and 1976 (64 fawns/100 does) and the lowest ratio in 1983 (28 fawns/100 does) (Figure 4-2). The cause of the variation in fawn recruitment is unknown. Where fawn survival is low, the buck-to-doe ratio must be improved to a higher number of does per buck.

### **Key Threats or Risk Factors**

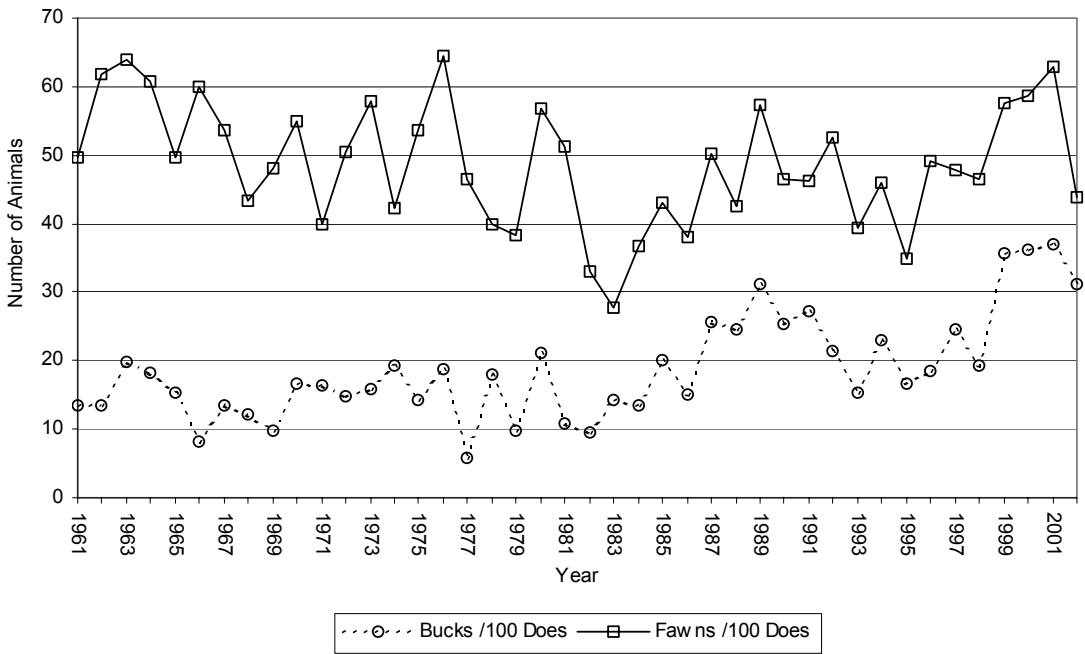
The Mule Deer Working Group of the Western Association of Fish and Wildlife, formed in 1998, is mapping mule deer habitat from Mexico to Canada and identifying specific regional management problems to stem the deer's decline across the West (see [www.muledeernet.org/mdwg.htm](http://www.muledeernet.org/mdwg.htm)). According to NDOW, mule deer populations in Nevada dropped from about 149,000 in 1993 to 109,000 in 2003.

Sagebrush/bitterbrush communities are important mule deer habitats, especially in the lower elevation winter range. Sagebrush habitats across the Intermountain West have suffered severe degradation and loss by agricultural conversion, invasion of non-native plants, extensive livestock grazing, development, sagebrush eradication programs, and changes in fire regimes (Paige and Ritter 1999). Natural fire cycles in sagebrush landscape have undergone changes. Sagebrush habitats are threatened by the invasion of cheatgrass, an exotic Russian brome, in the lower elevations. Cheatgrass invasion alters fire frequency and vegetation patterns in sagebrush habitats (Paige and Ritter 1999). Because fires occur more frequently in cheatgrass-dominated sites, sagebrush cannot reestablish itself easily. Only mature plants produce its seeds, and the seeds are not easily dispersed. Cheatgrass dominance eventually creates a uniform annual grassland perpetuated by large, frequent fires and void of remaining patches of native plant communities (Whisenant 1990 in Paige and Ritter 1999). Bitterbrush, a highly preferred browse on mule deer winter range, is sensitive to burning and responds variably to fire intensity, temperature, and season (Gruell 1986).

Increased development and wildland interface with growing urban areas and rural development along the Carson Range have greatly diminished the availability of lower elevation winter range for mule deer, especially in the sagebrush scrub and pinyon-juniper zones. Comments by Drs. Peter Brussard and Dennis Murphy (at University of Nevada, Reno) that were reported by Jeff DeLong in *The Reno Gazette-Journal* (dated August 21, 2000) indicate that development destroys critical winter habitats in the Carson Range foothills. NDOW and the Mule Deer Foundation also support this conclusion. Urban development has also contributed to the loss of suitable habitat for mule deer in the lower Clear Creek and Kings Canyon areas (M. Pious, personal observation 2003). The U.S. Highway 50 segment within the Clear Creek/Kings Canyon landscape analysis area contributes to mule deer mortalities (roadkill) from animal/vehicle collisions and also as barrier to migratory corridor.



**Figure 4-1. Mule Deer Population Estimate, based on Fall Census Data, for Management Unit 192 in Carson Range, 1961–2002**



**Figure 4-2. Herd Composition (sex and age ratios) for Mule Deer, based on Fall Census Data, for Management Unit 192 in Carson Range, 1961–2002**

## 4.4.2 Old Forest Habitat Associated Species

### Focal Species and Species-Habitat Relationships

The selected focal species for late successional/old forest habitat, based on the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a), include northern goshawk, white-headed woodpecker, California spotted owl, flammulated owl, and American marten. Based on the best available information describing species-habitat relationships, the preferred suitable habitat characteristics common for the focal species grouping or wildlife assemblage are: (1) old forest habitat stage (multi-strata or single-stratum, with a preponderance for multi-layered) with large trees (>24 inches dbh); (2) moderate (40 to 69 percent) or dense (70 percent or greater) overstory canopy closure; and (3) special habitat elements or decadent components such as large snags (with moderate decay) and downed wood/logs. Within the Clear Creek/Kings Canyon landscape analysis area, dominant forest cover types where these late successional/old forest associated species potentially occur include Jeffrey pine/ponderosa pine and mixed conifer (Jeffrey pine intermixed with white fir or red fir). These species also occur to a lesser extent in lodgepole pine and aspen cover types. The focal species' potential occurrences are mostly within the lower to mid-elevation montane conifer forest types.

The following background information on specific habitat requirements were used to develop a simplified species-habitat matrix for features common to the focal species assemblage: *The California Spotted Owl: A Technical Assessment of Its Current Status* (Verner and others 1992), *The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States* (Ruggiero and others 1994), *Flammulated, Boreal, and Great Gray Owls in the United States: A Technical Conservation Assessment* (Hayward and Verner 1994), and *The Northern Goshawk: Ecology and Management* (Block and others 1994). Species notes in species-specific survey methodology were also used.

### Status of Species-Population and Habitat

The Clear Creek/Kings Canyon landscape analysis area contains one California spotted owl PAC (Spooner A with 269 acres inside the landscape analysis area) located in northwest portion of Clear Creek (Table 2-3 and Map 2-3).

The landscape analysis area currently has two northern goshawk PACs (Spooner 13 with 200 acres inside the landscape analysis area and Chedic with 245 of 256 acres inside the landscape analysis area) (Table 2-3 and Map 2-3). Another northern goshawk PAC (Bliss with 268 acres outside the landscape analysis area) is located south of the Clear Creek watershed. Northern goshawks are year-round residents in the Lake Tahoe Basin (Keane 1999). NDOW observed northern goshawks during surveys conducted within the Lake Tahoe Nevada State Park (LTNSP). They identified northern goshawks at the upper end of the East Fork of Secret Harbor Creek in 2001 and at the upper end of Eagle Rock Creek (Edgewood Creek tributary) in 2002 (Espinosa 2001, 2002).

The USFS surveyed the California spotted owl and northern goshawk PACs on National Forest System lands during the 2002 and 2003 breeding seasons. The locations of the California spotted owl (Spooner A) and northern goshawk (Spooner 13) PACs overlap the 1991 inventoried old-growth Jeffrey pine forest located in the upper reaches of Clear Creek watershed (see Section 4.1.3, Old Forest Structural Stage).

American marten, a small forest carnivore, is known to occur throughout the Carson Range. NDOW did not detect marten in Lake Tahoe East Shore furbearer surveys conducted within the LTNSP in 2002. However, marten detections were made at two stations within the Van Sickle portion of LTNSP near Stateline, Nevada, and at another station within the Marlette Basin of the LTNSP (Espinosa 2003).

Information on the occurrences of white-headed woodpecker and flammulated owl is not available for the Clear Creek/Kings Canyon landscape analysis area. White-headed woodpecker, a year-round resident, has been sighted in the Spooner salvage project area within the Carson Range in recent years (Favre and Mark 1993). Flammulated owl, a neotropical migrant small forest owl, is known to breed throughout Carson Range. Flammulated owls were found to the north and south of the Spooner salvage project area within the Carson Range (Favre and Mark 1993).

An Old Forest Emphasis Area is a land allocation mapped by USFS based on existing old forest distribution and site capability. Old Forest Emphasis Areas cover approximately 8.5 percent (1,437 acres) of the Clear Creek/Kings Canyon landscape analysis area (Table 2-3 and Map 2-3). The delineated Old Forest Emphasis Area is restricted to the upper elevations of the Clear Creek watershed (Map 2-3). Further ground verification is needed for the Old Forest Emphasis Areas to evaluate potential habitat suitability for the old forest associated focal species.

Each of the focal species (e.g., northern goshawk, white-headed woodpecker, California spotted owl, flammulated owl, and American marten) has known or historic distribution within the Carson Range. Existing landscape-scale habitat conditions (e.g., forest cover types, vegetation structural stages, open/closed canopy closure, snags and downed wood/logs, and patch characteristics) within the Clear Creek/Kings Canyon landscape analysis area are predicted to have potential capability for the focal species. Tree-dominated, conifer forest types in the western portions of Clear Creek and Kings Canyon are of higher predicted value than other cover types, based on the existing forest composition and structure. However, the western portion of Kings Canyon may be marginally suitable based on the existing land ownership/use pattern. Additional information on the local distribution and habitat associations of focal species is needed for a more detailed evaluation of the status of their habitats and populations.

### **Focal Species Management**

Under the Sierra Nevada Forest Plan Amendment (see Appendix A in USDA Forest Service 2001a), land allocations and associated standards and guidelines are used as conservation strategies for focal species and their habitats. Land allocations applicable to the Clear Creek/Kings Canyon landscape analysis include: (1) California spotted owl PACs and home range core areas (HRCAs), (2) northern goshawk PACs, (3) forest carnivore den sites, (4) old forest emphasis areas, and (6) riparian conservation areas.

For California spotted owls, 300 acres of the best available habitat surrounding each territorial owl nest and roost site (arranged in as compact a unit as possible) were delineated by the USFS for protection. For northern goshawks, 200 acres of the best available forested habitat surrounding nest sites (arranged in the largest contiguous patches possible) were delineated for protection. For American marten, 100 acres of the highest quality habitat surrounding den sites (arranged in as compact a unit as possible) were delineated for protection. California spotted owl HRCA delineation

and protection applies to 1,000 acres of the best available habitat in the closest proximity to the owl activity center (including the 300-acre PAC). Limited operating periods are applied to PACs and den sites during nesting and denning seasons to protect breeding adults and their offspring (USDA Forest Service 2001a).

### **Key Threats or Risk Factors**

Several potential threats exist to species associated with old forest habitat. These include wildfire hazards resulting from advanced forest succession and accumulations of forest biomass, removal of deadwood components (snags and downed logs/wood) during fuel and vegetation treatments, and disturbances to nests and den sites from recreation and other human activities.

Catastrophic wildland fires can potentially result in landscape-level adverse impacts because they deplete the old forest ecosystems and fragment the habitats of selected focal species. Loss of special habitat elements or decadence components (snags and downed logs/wood) from fuels and vegetation treatments has potential adverse impacts, especially on species such as white-headed woodpecker, flammulated owl, and American marten. Goshawks are known to nest near roads and trails in the Genoa Peak Road and north Spooner State Park areas. Increased recreation and other human uses along the Tahoe Rim Trail, Kings Canyon Road, and Genoa Peak Road may influence behavior patterns and breeding success of goshawks and other sensitive wildlife species.

### **4.4.3 Riparian Habitat Associated Species**

#### **Riparian Area Management**

Riparian areas are transitional zones or ecotones that include interactions between aquatic and terrestrial systems. Riparian systems have close ecological relationships with adjacent uplands. The functional category, riparian habitat associated species, is important for specific sensitive or indicator species, including neo-tropical migratory birds. Riparian vegetation management is essential to maintain and/or enhance riparian wildlife and associated ecological patterning.

The Sierra Nevada Forest Plan Amendment addresses the conservation of aquatic and riparian ecosystems with Riparian Conservation Areas and Riparian Management Objectives (USDA Forest Service 2001a). On January 10, 2001, President Clinton signed an Executive Order entitled “Responsibilities of Federal Agencies to Protect Migratory Birds.” Subsequently, on January 17, 2001, the USFS and USDI Fish and Wildlife Service signed a Memorandum of Understanding to complement the Executive Order. Nevada Partners In Flight is also actively involved in addressing bird conservation in Nevada, including neotropical migrant birds (Neel 1999).

Riparian Conservation Areas (RCAs), a land allocation under the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a), encompass 1,466 acres (8.7 percent of the total landscape analysis area) along perennial and intermittent streams in the Clear Creek/Kings Canyon landscape analysis area (see Table 2-3 and Map 2-3). Distribution of the RCAs within the landscape analysis area is as follows: 7.4 percent (762 acres) of Clear Creek, 11.3 percent (471 acres) of Kings Canyon, and 9.4 percent (231 acres) of Voltaire Canyon.



### Riparian Vegetation and Wildlife Species

Riparian habitats are dominated by black cottonwood (*Populus balsamifera*) or quaking aspen (*Populus tremuloides*), willow (*Salix* spp.), and graminoids. Other common riparian vegetation associates are cattails (*Typha* spp.), rushes (*Juncus* spp.), and sedges (*Carex* spp.).

Table 4-10 lists species associated with riparian habitat within Carson Range. These species potentially occur in the Clear Creek/Kings Canyon landscape analysis area. No formal surveys for species associated with riparian habitat have been conducted in the landscape analysis area. Incidental sightings of Carson Valley silver spotted butterfly and Sierra alligator lizard have been recorded in Kings Canyon and Clear Creek, respectively.

**Table 4-10. Riparian Habitat Associated Species within Carson Range that Potentially Occur in the Clear Creek/Kings Canyon Landscape Analysis Area**

Taxa	Common Name	Scientific Name
Birds	American dipper	<i>Cinclus mexicanus</i>
	Belted kingfisher	<i>Ceryle alcyon</i>
	Common merganser	<i>Mergus merganser</i>
	Downy woodpecker	<i>Picoides pubescens</i>
	Lesser goldfinch	<i>Carduelis psaltria</i>
	Lincoln's sparrow	<i>Melospiza lincolnii</i>
	Macgillivray's warbler	<i>Oporornis tolmiei</i>
	Pine grosbeak	<i>Pinicola enucleator</i>
	Song sparrow	<i>Melospiza melodia</i>
	Spotted sandpiper	<i>Actitis macularia</i>
	Tree swallow	<i>Tachycineata bicolor</i>
	White crowned sparrow	<i>Zonotrichia leucophrys</i>
	Willow flycatcher	<i>Empidonax traillii</i>
	Wilson's warbler	<i>Wilsonia pusilla</i>
Mammals	Beaver	<i>Castor canadensis</i>
	Dusky shrew	<i>Sorex monticolus</i>
	Mink	<i>Mustela vison</i>
	Montane vole	<i>Microtus montanus</i>
	Mountain beaver	<i>Aplodontia rufa</i>
	Muskrat	<i>Ondatra zibethicus</i>
	Raccoon	<i>Procyon lotor</i>
	River otter	<i>Lutra canadensis</i>
	Vagrant shrew	<i>Sorex vagrans</i>
	Water shrew	<i>Sorex palustris</i>
Amphibians and Reptiles	Mountain yellow-legged frog	<i>Rana muscosa</i>
	Pacific tree frog	<i>Hyla regilla</i>
	Common garter snake	<i>Thamnophis sirtalis</i>
	Northern alligator lizard	<i>Elgaria coerulea</i>
	Western aquatic garter snake	<i>Thamnophis couchi</i>
	Western terrestrial garter snake	<i>Thamnophis elegans</i>
Invertebrates	Carson Valley silverspotted butterfly	<i>Speyeria nokomis</i>

Source: UNR 2003c

Willow flycatcher (a neotropical migrant bird) and yellow-legged frog (an aquatic amphibian) are the selected focal species for aquatic, riparian, and meadow habitats. Current occurrences and historical distributions of willow flycatcher and mountain yellow-legged frog in the Clear Creek/Kings Canyon landscape analysis area are unknown. Based on local knowledge, suitable habitat for the willow flycatcher and yellow-legged frog is not known to occur within the analysis area, and the capability of the existing landscape to meet the specific habitat requirements for these species is marginal (M. Easton, personal communication 2003).

## **Key Threats or Risk Factors**

Potential threats to riparian associated species are habitat loss from wildland interface development, habitat modification by wildfires, and conifer encroachment in riparian forest types. Riparian wildlife species and landscape corridors can be severely impacted by the loss of riparian habitats with increased development and wildland interface around forestlands. Fire exclusion has changed species composition in riparian and aspen communities in the Clear Creek/Kings Canyon landscape analysis area. Without natural disturbance by fire, conifers have become more prevalent in the riparian communities. Changes in riparian vegetation and loss of wildlife movement corridors result in potential adverse impacts to biological diversity within the analysis area.

## **4.5 Watershed Condition**

### **4.5.1 Hydrology and Stream Channels**

The hydrology of a watershed includes the amount, intensity, and timing of water movement. Climate, vegetation, other physical and biological factors, and landuse/management affect watershed hydrology. The most significant meteorological events that affect runoff and streamflows in the Clear Creek/Kings Canyon landscape analysis area are convective summer thunderstorms and rain-on-snow events (rainstorms that partially or completely melt snowpacks). A typical 2-year rain event in the landscape analysis area results in 1.4 to 2.5 inches of rain, while the 100-year event can leave more than 5 inches (PBS&J 2003). During rain-on-snow events, rainfall saturates existing snowpacks and causes rapid melting, leading to large volumes of runoff (water that flows over the surface without infiltrating into the soil) during relatively short periods of time.

Climate data collected within the Clear Creek/Kings Canyon landscape analysis area are unavailable. Nearby climate stations exist at Carson City (at an elevation of 4,650 feet above sea level) and Dagget Pass (at an elevation of 7,330 feet above sea level) (Western Regional Climate Center 2003). Although these stations are less than one and approximately 25 miles outside of the analysis area, respectively, they are likely sufficiently near to the landscape analysis area to represent the range of conditions between low and high elevations there. These data indicate that average annual precipitation near the Clear Creek/Kings Canyon landscape analysis area ranges from approximately 11 to 24 inches, with most falling as rain at lower elevations and snow at higher elevations. Average monthly temperatures range from 89°F in July in Carson City to 21°F in December and January in Carson City and December, January, and February in Dagget Pass (see Appendix F for climate data). Precipitation not lost to evaporation or transpiration either infiltrates into soils or flows downhill as runoff, eventually draining from the analysis area via groundwater or streamflow.

The primary stream channels within the Clear Creek/Kings Canyon landscape analysis area are Clear Creek, Kings Canyon Creek, and Voltaire Canyon Creek (Map 4-6). Voltaire Canyon Creek is an intermittent stream, flowing during most of the year but dry during low flows. Both Clear Creek and

Kings Canyon Creek are perennial. Streamflow data are available from several U.S. Geological Survey gages on these streams, including:

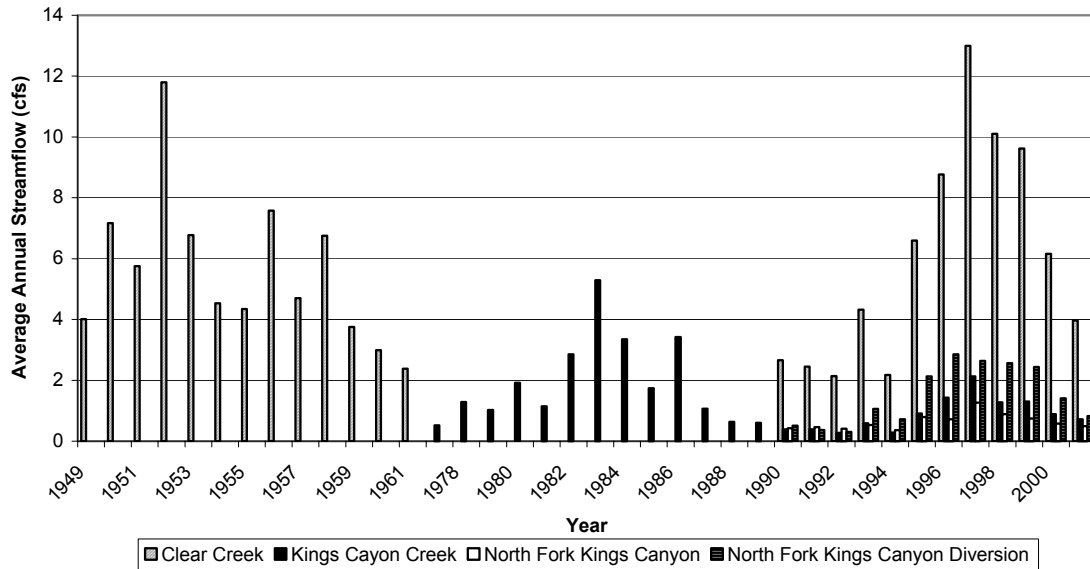
- Clear Creek (10310500, drainage area of 15.5 square miles [ $\text{mi}^2$ ])
- Kings Canyon Creek (10311100, drainage area of  $4.06 \text{ mi}^2$ )
- North Fork Kings Canyon (10311090, drainage area of  $1.83 \text{ mi}^2$ )
- North Fork Kings Canyon Diversion (10311089, drainage area of  $1.83 \text{ mi}^2$ )

Average annual streamflow and annual hydrographs for the period of record at each gage appear in Figures 4-3 and 4-4. In general, flows are higher in the larger Clear Creek watershed than in the Kings Canyon watershed. The highest annual peak flows on record at any of these gages occurred on January 2, 1997, during a rain-on-snow event that produced streamflows of 276 cubic feet per second (cfs) in Kings Canyon Creek and 266 cfs in Clear Creek (USDI Geological Survey 2003). This hydrologic event also impacted the Carson River downstream, resulting in streamflows of 30,500 cfs, the highest flow on record at the USGS gage in Carson City (10311000).

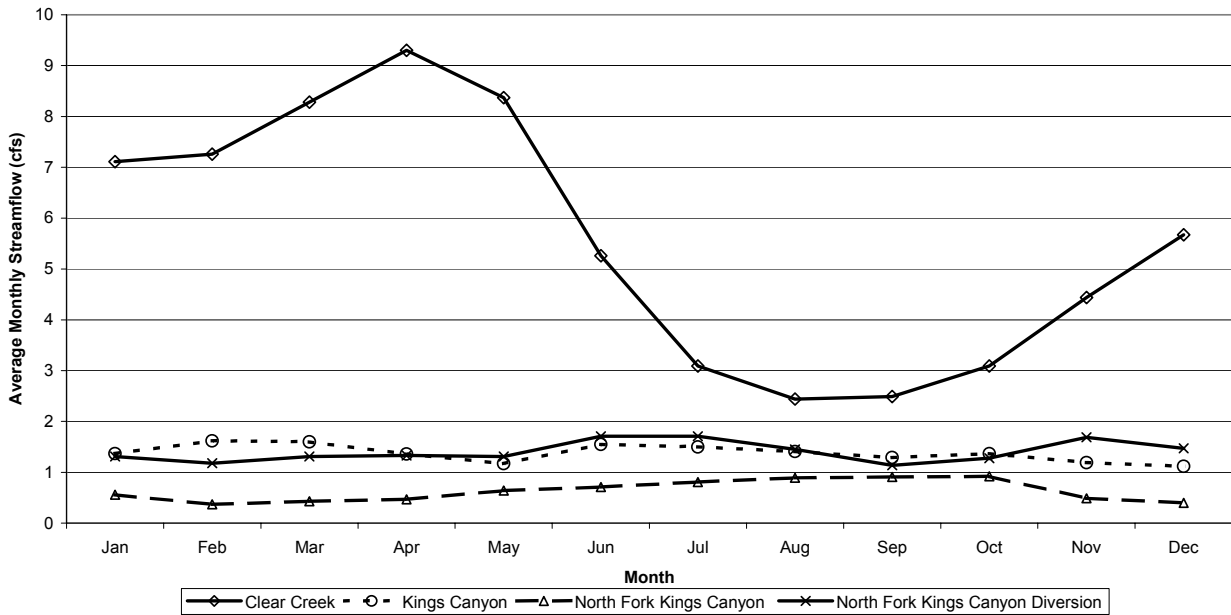
Water diversions impact streamflows in Kings Canyon Creek and Clear Creek and in smaller streams throughout the landscape analysis area (USDI Geological Survey 2003). Diversions generally affect the hydrologic regime by reducing streamflows, particularly during dry seasons. In particular, diversions tend to reduce peak flows and can result in more frequent low flows, including periods of no flow. In addition to diversions, other human activities have impacted the hydrologic regime of the analysis area by modifying runoff, another component of the hydrologic regime.

Anthropogenic activities have influenced runoff processes to some extent in the Clear Creek/Kings Canyon landscape analysis area (PBS&J 2003). The primary human impacts include: (1) clearing and/or damaging the established vegetation cover in the watershed, (2) increasing runoff potential through the construction of impervious surfaces (e.g., rooftops and roads), and (3) increasing the destructive energy of runoff by concentrating flows in drainage facilities (e.g., culverts), and modifying drainage patterns to areas that historically did not convey substantial runoff (PBS&J 2003). Some of these activities have affected runoff on National Forest System lands, although the extent of the changes has not been documented (PBS&J 2003).

The drainage density of the dendritic pattern on the uplands of the Clear Creek/Kings Canyon landscape analysis area is generally low (Table 4-11 and Map 4-6). Low drainage densities generally correspond with low surface runoff rates (USDA Forest Service 1993a). Intense rainfall events cause sheet or rill erosion on finer-textured soils with relatively little protective ground cover. However, infiltration and percolation rates are high in sandy soils like those of the analysis area. Consequently, rainfall infiltrates into the soil and moves as subsurface flow instead of surface runoff. As a result, runoff rates can be low even after intense rainfall, resulting in relatively infrequent rill or gully erosion on upland sites.



**Figure 4-3. Average Annual Streamflow (1949–2001) for Streamgages within the Clear Creek/Kings Canyon Landscape Analysis Area.**  
Source: USDI Geological Survey 2003.



**Figure 4-4. Average Monthly Streamflow (Based on Flow Data from 1949 to 2001) for Streamgages within the Clear Creek/Kings Canyon Landscape Analysis Area.**  
Source: USDI Geological Survey 2003.

**Table 4-11. Stream Lengths and Densities by Flow Regime-Based Stream Types in the Clear Creek/Kings Canyon Landscape Analysis Area**

Stream Type	Clear Creek		Kings Canyon		Voltaire Canyon		Landscape Analysis Area	
	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )
Intermittent	24.6	1.54	4.1	0.63	7.4	1.92	36.1	1.37
Perennial	12.4	0.78	8.8	1.36	0.1	0.02	21.3	0.81
Total	37.1	2.32	12.9	1.99	7.5	1.94	57.5	2.18

Source: Humboldt-Toiyabe National Forest GIS Data.

#### 4.5.2 Erosion and Sedimentation

The soils in the landscape analysis area are predominantly derived from white, quartz-rich, coarse-grained granite (Cretaceous Quartz diorite and granodiorite) (Nevada Bureau of Mines and Geology 2003). Lower elevations, particularly in the Voltaire Canyon and Kings Canyon subareas, are underlain by the Triassic Holbrook member of the Moenkopi Formation—a brown mudstone largely composed of muds and silts, transported from mountains by streams and distributed by tidal currents traversing the flats in tidal channels (Nevada Bureau of Mines and Geology 2003). More basic igneous rocks are observed in isolated outcrops. A fine-grained white rhyolite is associated with a slump adjacent to Clear Creek Road (Old Highway 50) (USDA Forest Service 1993a). Exposed and fractured granite weathers relatively easily.

In general, soils are on moderately steep to very steep (15 to 65 percent) terrain, mountain slopes with inclusions of elevated plains (five to 15 percent), and granite rock outcrops (USDA Forest Service 1993a; USDA Soil Conservation Service 1979, 1984). Observations of forest floor indicate two to 15 tons per acre of litter and woody material, but little coarse woody material. Many of the sandy soils of the Clear Creek/Kings Canyon landscape analysis area are formed in residuum and colluvium derived from granite. The shallow soils in the analysis area are associated with convex slopes and contours on steep to very steep (between 40 and 75 percent) slopes (USDA Forest Service 1993a) (Map 4-7). The soil textures are commonly loamy sand and fine to coarse sand with a low percentage of fine particles. Consequently, the potential for suspended sediments in streams of this area is relatively low compared to areas covered in finer-grained soils. The moderately deep soils are associated with straight and concave contours. Most of the deeper, moister soils in the area are associated with colluvium on concave slopes and contours, most frequently in channels and adjacent sideslopes with 15 to 40 percent gradients. The sandy soils within the analysis area have a single-grain structure throughout their profiles. Infiltration and percolation rates are high on exposed bare soil and where little cover exists. The potential for soil compaction is slight to non-applicable on these soils (USDA Forest Service 1993a). These soils have a very low water holding capacity and low inherent fertility. Surface runoff rates appear to be low, and subsurface flows are generally high (USDA Forest Service 1993a).

Given the general loose sandy soils throughout the Clear Creek/Kings Canyon landscape analysis area, soil erosion most commonly occurs during surface runoff events, which are relatively rare in the area. The process of soil erosion involves particle detachment and the subsequent transport of detached particles in runoff events. The soils in the analysis area are inherently detached because of their coarse texture and lack of cohesive, fine-grained materials (USDA Forest Service 1993a). Rainfall impact does not change their single-grain structure, as it does fine-textured soils. Instead,

soil particles are relatively available for transport during runoff events. However, as previously described, the high infiltration rates result in more subsurface flow than surface runoff. Some of the heavier sands of these coarse-textured soils can be suspended in surface runoff. However, these particles generally settle out with decreasing overland flow velocity, and live vegetation, litter, and woody material interrupt slopes, forming short slope lengths and reducing the erosion hazard.

Although runoff is rapid to very rapid in this area, soils have high infiltration rates. As a result, during intense rainstorms, precipitation infiltrates into the sandy soils and moves through as subsurface flow instead of runoff. Similarly, after snowmelt soils are saturated, and the melting water moves downhill largely through subsurface flow. During relatively rare rain-on-snow events in this area, the much of the rainwater moves downhill overland as runoff because soils are already saturated by snowmelt. These rain-on-snow events lead to the largest surface erosion events in most parts of the Clear Creek/Kings Canyon landscape analysis area. Water also collects more readily in deeper soils located in concave slopes and drainages, resulting in more frequent saturation than in shallower soils. Runoff occurs more commonly, resulting in surface erosion, in these saturated deeper soils in concave slopes and drainages. Very steep slopes throughout the analysis area also result in periodic mass wasting (including slumps, slides, and soil creep), particularly in areas with deeper, moister soils. Erosion from these very steep areas is part of the natural geologic erosion regime of this mountainous area (USDA Forest Service 1993a).

Over the last 50 years, extreme weather events, coupled with past land management, resulted in localized mass erosion on some hillsides throughout the Clear Creek/Kings Canyon landscape analysis area (S. Phippen, field observation 2003). Concentrated runoff from roads has resulted in significant erosion in parts of the Clear Creek watershed and other areas. In these instances, eroded materials are either redeposited on the hillslope or tributary were likely delivered to the area streams (PBS&J 2003).

A watershed condition analysis conducted in support of the USFS's Spooner Salvage Environmental Assessment (USDA Forest Service 1993a) estimated an erosion rate of approximately 1,380 pounds per acre annually in the upper, forested Clear Creek watershed. According to the study, this area includes 80 percent of the watershed, but yields less than 10 percent of the total sediment to Clear Creek. The study identified roads and associated gullies as the most significant sediment sources; 87 percent of all sediment came from these features. Of that 87 percent, more than 70 percent of the erosion was associated with U.S. Highway 50, approximately 13 percent came from the Old Highway 50), and less than five percent was associated with access roads (USDA Forest Service 1993a). Sheet and rill erosion formed a small component (approximately 12 percent) of the total sediment measured. Very steep slopes were also identified as sediment sources. Mass failures have occurred near road cuts and steep areas throughout the analysis area (USDA Forest Service 1993a). Bank erosion, enhanced by grazing, also accounted for over three percent of the total sediment yield to Clear Creek.

Several factors influence soil erosion and sediment delivery to streams in this area, including slope gradient, soil thickness (depth to bedrock), vegetative cover and root strength, and climatic factors. In a 2003 erosion assessment study conducted to determine the impacts of the Old Highway 50 on the Clear Creek watershed, PBS&J concluded that approximately 10 percent of the drainage structures and drainage corridors from the highway had a relatively high erosion rate, 15 percent had

a relatively moderate erosion rate, and 75 percent had a low or minimal erosion rate. Within the Sierra Nevada, Costick (1996) developed a list of criteria to rank watersheds on the Eldorado National Forest by potential soil erosion and stream sedimentation. Slope, vegetative cover, and soil detachability are considered the most significant contributors to soil erosion, given relatively uniform climatic conditions.

Slope classes vary within the Clear Creek/Kings Canyon landscape analysis area (Map 4-7). Using the available terrain data for the analysis area, a relative vulnerability ranking for erosion based on areas of low, moderate, and high slope gradients and lower, middle, and upper slope positions was conducted (Table 4-12). Slopes greater than 40 percent are most susceptible to erosion (USDA Forest Service 1993a). Soils are generally deeper and more likely to experience surface runoff and erosion in lower slope positions. In addition, slope lengths are shortest in lower slope positions, providing a higher potential for eroded sediment to reach streams. Applying this relational matrix of physical parameters to the Clear Creek/Kings Canyon landscape analysis area results in most areas defined with relatively moderate vulnerability for erosion (Table 4-13; Maps 4-6 and 4-7). Less than 20 percent of the analysis area has the slope gradients and slope positions likely to result in relatively high vulnerability for erosion. These areas make up the largest portion of the Clear Creek watershed.

**Table 4-12. Relational Matrix of Slope Gradients and Slope Positions for Relative Vulnerability to Erosion Determination**

Slope Position	Slope Class		
	0–20%	21–40%	>40%
Upper 20%	Low	Low	Moderate
Middle 40%	Low	Moderate	Moderate
Lower 40%	Moderate	Moderate	High

**Table 4-13. Relative Vulnerability to Erosion in Clear Creek/Kings Canyon Landscape Analysis Area**

Name	Relative Vulnerability to Erosion					
	High		Moderate		Low	
	Area (acres)	Proportion (%)	Area (acres)	Proportion (%)	Area (acres)	Proportion (%)
Clear Creek	1,717	17	6,479	64	1,974	19
Kings Canyon	574	14	2,631	63	956	23
Voltaire Canyon	340	14	1,520	63	559	23
Landscape Analysis Area	2,631	16	10,629	63	3,489	21

Based on the relational matrix shown in Table 4-12.

Source: USDI Geological Survey 10-meter digital elevation model-based terrain analysis

### 4.5.3 Clear Creek Watershed Condition and Improvements

Not only does the Clear Creek watershed have a slightly higher proportion of steeper slopes and lower slope positions (17 percent of the area) than the other landscape analysis subareas, this area also contains U.S. Highway 50 and Clear Creek Road (Old Highway 50) (Map 4-4). Much erosion and sedimentation in this watershed has been attributed to these features. Additional information regarding the roads in the Clear Creek/Kings Canyon landscape analysis area can be found in Section 4.6, which deals with roads.

According to the 2003 erosion assessment study (PBS&J 2003), “Clearly, in some areas of the [Clear Creek] watershed human activity and associated modifications to the environment have accelerated erosion and likely increased the sediment load to the Clear Creek main channel” (page 28). Specifically, anthropogenic changes to watershed hydrology (discussed above in Section 4.5.1) have resulted in greater quantities of concentrated runoff, leading to increased erosion. However, the extent of anthropogenic erosion has not been quantitatively defined. An estimate of the sediment load in the Clear Creek channel was prepared in the late 1970s. Fisher concluded that the total average sediment load in the channel between 1975 and 1977 was approximately 2,200 grams per minute (Fisher 1978, in PBS&J 2003).

Sources of erosion throughout the Clear Creek watershed were identified in the erosion assessment study (PBS&J, 2003). Locations were evaluated in the field according to existing erosion severity, future erosion potential, and the risk that the area may cause future damage to existing infrastructure, including U.S. Highway 50. The majority of sites (75 percent) were classified as having a low to minimal erosion rate. Approximately 10 percent were classified with a relatively high erosion rate (PBS&J 2003). These sites identified as high were prioritized based on their relative potential to contribute sediment to the Clear Creek main channel. Mitigation measures that would reduce the sediment delivered to Clear Creek (Priority Category 1), protect U.S. Highway 50 (Priority Category 2), and have significant impact on localized erosion (Priority Category 3) were identified for each of these high erosion areas. In general, mitigation measures include repairing culvert outlets, reducing tributary channel erosion, protecting slopes, minimizing bank erosion on the Clear Creek mainstem, and stabilizing headcuts. Maintenance activities are also proposed for each alternative. Of these proposed mitigation measures, several would involve activities on Forest System lands managed by the USFS. Implementation of the mitigation measures is recommended to improve watershed conditions.

Four projects were proposed in the erosion assessment study (PBS&J, 2003), including combinations of the mitigation measures in areas that were deemed to have the greatest potential for success at the best cost-benefit ratio. Some of the planned activities proposed in these four projects would occur on National Forest System lands. (Appendix G provides detailed information on these projects.) The watershed mitigation measures that would occur on National Forest System lands are shown in Map 4-6. This work would consist of slope and gully stabilization or construction of sediment retention basins, and some of it would occur upslope from Clear Creek. The USFS would need to complete the NEPA process for the proposed activities on National Forest System lands.

#### **4.5.4 Water Quality and Water Use**

Several water quality issues have been identified in the Clear Creek/Kings Canyon landscape analysis area. The Clear Creek Watershed Council was formed to protect, conserve, and restore Clear Creek and the Clear Creek watershed in response to recent concern over potentially elevated sediment levels in the stream (Clear Creek Watershed Council 2003). Segments of the Carson River have been included in the Clean Water Act Section 303(d) list of impaired surface water bodies (prepared by the state of Nevada) for elevated pH, total dissolved solids, sulfate, chlorides, turbidity, and fecal coliform (EPA 2003). Sediments of the Carson River below Carson City also contain high levels of mercury (Nevada Division of Environmental Protection 2003). A Total Maximum Daily Load (TMDL) report was prepared for biochemical oxygen demand, nitrate, phosphate, and total dissolved solids in the Carson River watershed in 1982 (Nevada Division of Environmental



Protection 1982). Another TMDL report is being prepared for sediments and nutrients in the Carson River watershed. Within the Clear Creek/Kings Canyon landscape analysis area, the segment of Clear Creek between the origin and the USGS gauging station (located in Section 1, Township 14N, Range 19E) was listed in the 2002 Clean Water Act 303(d) list for pH (Map 4-6). This listing may be reevaluated relatively soon following the release of revised pH standards by the Nevada Division of Environmental Protection (EPA 2003).

Beneficial uses within this portion of the Carson River Basin include irrigation, watering of livestock, recreation both involving and not involving contact with the water, industrial supply, municipal and domestic water supply, propagation of wildlife, and propagation of aquatic life (Nevada Administrative Code 2003). The water supply in the surrounding area is limited (USDA Soil Conservation Service 1979). Municipal and domestic water supply demands generally takes priority over irrigation needs. Most domestic water comes from groundwater sources and the Carson River and is supplemented by water from lakes in the Carson Range (USDA Soil Conservation Service 1984). All surface water rights on the Carson River are allocated. The majority of the water rights are for agricultural uses. Almost all domestic and municipal water supplies are provided from groundwater sources. The demand for groundwater has become so great that the use of groundwater is designated. Permits for use of irrigation are needed, and the number of wells used for irrigation is controlled.

## **4.6 Roads**

### **4.6.1 Existing Road and Trail Network**

The existing road system within the Clear Creek/Kings Canyon landscape analysis area includes U.S. Highway 50, Clear Creek Road (Old Highway 50), Kings Canyon Road, Voltaire Canyon Road, and several other classified roads including paved, dirt, and unimproved roads, totaling approximately 63 miles in length (Map 4-4 and Table 4-9). In general, classified roads include roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access (including state roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the USFS) (36 CFR 212.1, FSM 7705—Transportation System) (USDA Forest Service 2003b). The Clear Creek Road is gated and closed to vehicles, but it is still available for administrative use. In addition, the landscape analysis area includes another 10 miles of unimproved 4WD trails. These unimproved 4WD trails are largely used as motorized trails for OHVs. An additional eight miles of non-motorized trails also exist throughout the landscape analysis area. The recreational aspects of roads and trails within the Clear Creek/Kings Canyon landscape analysis area are discussed in Section 4.2.1.

HTNF completed a roads analysis and planning process in 2003 for future road management. Road Management Objectives (RMOs) define the intended purpose of an individual road based on management area direction and access management objectives. Road management objectives contain design criteria, operation criteria, and maintenance criteria (USFS Handbook 7709.55, Sec. 33—Transportation Planning Handbook) (USDA Forest Service 2003b). Within the Clear Creek/Kings Canyon landscape analysis area, RMOs are available for Kings Canyon Road (road number 41039) and Voltaire Canyon Road (road number 41710) (USDA Forest Service 2003c) and are included in Appendix H-1 and H-2, respectively. Kings Canyon Road is an arterial road—the functional class for a forest road that provides service to large land areas and connects with other arterial roads or public highways (USFS Handbook 7709.54—Forest Transportation Terminology Handbook)

(USDA Forest Service 2003b). Voltaire Canyon Road, a collector road, serves a smaller land area. In general, collector roads usually connect forest arterial roads to local forest roads (USFS Handbook 7709.54—Forest Transportation Terminology Handbook) (USDA Forest Service 2003b).

Both Kings Canyon Road and Voltaire Canyon Road are managed for long-term constant use and for access needs that include recreation, mineral development, private property, fuels management, livestock management, administrative activities, and emergency fire suppression. Management goals for these roads are to protect resources and property from wildfire; to facilitate dispersed recreation on National Forest System lands, including providing roaded natural experiences and high visual quality; and to provide access for vegetation management to minimize the potential for catastrophic wildfire and insect and disease infestation. According to the RMOs, traffic on these roads averages 10 to 20 daily trips, qualifying them for traffic service level C, flow interrupted and use limited, and level D, slow flow or may be blocked (USFS Handbook 7709.56—Road Preconstruction Handbook) (USDA Forest Service 2003b). Uses for these roads and others in the Clear Creek/Kings Canyon landscape analysis area include commercial access for grazing allotments and sand pits, public access for dispersed recreation, private access for landowners, and administrative access for Carson City, the USFS, and the Bureau of Indian Affairs, including multi-agency fire surveillance and suppression (USDA Forest Service 2003c).

According to USFS Manual 7705 (Transportation System) (USDA Forest Service 2003b), road jurisdiction is the legal right to control or regulate the use of a transportation facility. Jurisdiction requires authority, but not necessarily ownership. The existing road network falls under the jurisdiction of several entities, including NDOT (U.S. Highway 50), Carson City and Douglas County, private landowners, and the USFS. The jurisdiction of Kings Canyon Road includes private, county, and USFS. Voltaire Canyon Road falls under both private and USFS jurisdiction.

Current operational maintenance levels are not available for all roads and trails in the Clear Creek/Kings Canyon landscape analysis area (S. Champion, personal communication 2003). Both Kings Canyon Road and Voltaire Canyon Road are maintained at Maintenance Level 2 and 3 throughout their lengths in the landscape analysis area (USDA Forest Service 2003c). Most improved dirt roads in the area are likely maintained at Maintenance Level 3—the level assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. By definition, these roads are maintained by either encouraging or accepting passenger vehicles (USFS Manual 7705, Transportation System) (USDA Forest Service 2003b). Most improved dirt roads in the area are likely maintained at Maintenance Level 2—the level assigned to roads open for use by high clearance vehicles. By definition, appropriate traffic management strategies for roads at Maintenance Level 2 are either (a) to discourage or prohibit passenger cars or (b) to accept or discourage high clearance vehicles. The USFS, the Bureau of Indian Affairs, and private landowners maintain the Kings Canyon Road and Voltaire Canyon Road. Maintenance includes surface blading and shaping for proper drainage, cleaning debris from culverts and drainage crossings, monitoring and repair of bank erosion near drainage crossings, and any necessary surface replacement. Existing cattle guards and allotment fences are also maintained.

#### **4.6.2 Roads-Related Erosion and Sedimentation**

As has been widely reported (Amaranthus and others 1985; Bilby and others 1989; Donald and others 1996; Kochenderfer and others 1997; Megahan and Kidd 1972; Reid and Dunne 1984; Rice

and Lewis 1986; Rothacher 1971; Sullivan and Duncan 1981; Swanson and others 1981; Swift 1985, 1988), roads in managed forests can have significant impacts on rates of soil erosion, mass wasting, and sedimentation to streams. In the Clear Creek/Kings Canyon landscape analysis area, roads too have been identified as the primary contributors to watershed sedimentation (PBS&J 2003; USDA Forest Service 1993a). Long-term erosion and sedimentation issues associated with U.S. Highway 50 have been identified and documented (PBS&J 2003) as indicated in Section 4.5. These chronic sediment sources likely contributed greater sediment loads to Clear Creek following the 1997 flood in the landscape analysis area. The 1997 flood also damaged several unpaved roads in the area, causing increased hydrologic connectivity and accelerated sediment delivery to streams (USDA Forest Service 2003c). The RMOs for both Kings Canyon Road and Voltaire Canyon Road identify road maintenance, including realignments and relocations, as a key environmental consideration to minimize soil erosion and sediment delivery to streams.

Except for U.S. Highway 50 and paved portions of Clear Creek Road, road surfaces in the Clear Creek/Kings Canyon landscape analysis area are comprised of native materials. Gravel covers segments of some roads to provide localized surface stabilization. Roads in the area are generally outsloped with rolling dips that are designed to provide adequate drainage. Stream crossings on Kings Canyon Road and Voltaire Canyon Road are designed to handle 100-year runoff events (USDA Forest Service 2003c).

Overall road densities in the Clear Creek/Kings Canyon landscape analysis area are moderately high—an average density of 2.4 miles of road per square mile (not including motorized [unimproved four-wheel drive, 4WD] or non-motorized trails) (Table 4-14). According to HTNF GIS data, road densities are greatest in mixed private and tribal lands, at 5.4 miles per square mile (Table 4-14). Nevada state lands in the landscape analysis area have an average road density of 4.1 miles per square mile, followed by private lands with 3.7 miles per square mile, Carson City with 1.7 miles per square mile, and the USFS with 1.5 miles per square mile. The National Forest System and Carson City lands in the landscape analysis area have moderate road densities, whereas, other lands have relatively high road densities.

Unimproved roads (Type 6) make up the longest portion of the existing road network in the Clear Creek/Kings Canyon landscape analysis area at more than 38 miles (an average density of 1.5 miles per square mile) (Table 4-14). Combined road and trail densities are highest in Voltaire Canyon, at 3.9 miles per square mile (Table 4-15).

Several roads within the Clear Creek/Kings Canyon landscape analysis area traverse areas identified as relatively more vulnerable to erosion, based on slope gradient and slope position. These areas of relatively higher vulnerability to erosion are described in detail in Section 4.6.3 and the relational matrix in Table 4-12. Approximately 2.5 miles of unpaved roads and 0.5 mile of motorized (unimproved 4WD) and non-motorized trails cross these areas identified with relatively higher vulnerability to erosion, resulting in densities of 0.1 and less than 0.1 mile per square mile, respectively (Table 4-16). Accelerated erosion rates attributed to roads in the Clear Creek watershed may be related to the density of roads in that area and location of roads in sensitive areas. The Clear Creek area has almost three miles of roads in areas with relatively high vulnerability to erosion, approximately 76 percent of all roads in the landscape analysis area and substantially more than in Kings Canyon or Voltaire Canyon (Table 4-17). Still, the density of these roads is low, at approximately 0.2 mile per square mile.

**Table 4-14. Road and Trail Lengths and Densities by Road or Trail Type and Land Ownership in Clear Creek/Kings Canyon Landscape Analysis Area**

Road or Trail Type	Carson City		Private/Tribal		National Forest		Private		State		Landscape Analysis Area	
	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )
1—Primary Highway	0	0	0	0	3.8	0.24	4.2	0.50	0.9	0.88	8.8	0.33
3—Improved, Paved	0.2	0.28	0.1	0.16	0.8	0.05	4.0	0.48	0.5	0.47	5.5	0.21
5—Improved, Dirt	0	0	1.0	2.02	6.1	0.39	3.3	0.40	0.1	0.05	10.5	0.40
6—Unimproved	1.0	1.39	1.7	3.26	13.6	0.86	19.4	2.34	2.6	2.65	38.4	1.46
7—Unimproved, 4WD	0	0.02	0	0	8.8	0.56	1.5	0.18	0	0	10.3	0.39
Trail	0.6	0.78	0	0	4.1	0.26	1.7	0.21	1.5	1.54	7.9	0.30
Total	1.8	2.47	2.8	5.43	37.2	2.35	34.1	4.11	5.5	5.59	81.4	3.09

Source: Humboldt-Toiyabe National Forest GIS data.

**Table 4-15. Road and Trail Lengths and Densities in Clear Creek/Kings Canyon Landscape Analysis Area**

Name	Length (mi)	Density (mi/mi <sup>2</sup> )
Clear Creek	49.2	3.08
Kings Canyon	17.1	2.62
Voltaire Canyon	15.1	3.93
Landscape Analysis Area	81.4	3.09

Source: Humboldt-Toiyabe National Forest GIS data.

**Table 4-16. Road and Trail Lengths and Densities by Road or Trail Type and Relative Vulnerability to Erosion**

Road or Trail Type	High		Moderate		Low	
	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )
1-Primary Highway	0.4	0.02	7.1	0.27	1.3	0.05
3-Improved, Paved	0.3	0.01	4.6	0.18	0.6	0.02
5-Improved, Dirt	1.1	0.04	8.3	0.32	1.1	0.04
6-Unimproved	1.4	0.05	25.6	0.97	11.4	0.43
7-Unimproved, 4WD	0.1	0.00	5.0	0.19	5.2	0.20
Trail	0.4	0.01	4.4	0.17	3.2	0.12
Total	3.7	0.14	55.0	2.09	22.7	0.86

Source: Humboldt-Toiyabe National Forest GIS data; USGS 10-meter digital elevation model-based terrain analysis.

**Table 4-17. Road and Trail Lengths and Densities by Relative Vulnerability to Erosion in Clear Creek/Kings Canyon Landscape Analysis Area**

Name	High		Moderate		Low	
	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )
Clear Creek	2.8	0.18	34.9	2.18	11.5	0.72
Kings Canyon	0.5	0.07	11.4	1.75	5.2	0.80
Voltaire Canyon	0.4	0.10	8.7	2.27	6.0	1.56
Landscape Analysis Area	3.7	0.14	55.0	2.09	22.7	0.86

Source: Humboldt-Toiyabe National Forest GIS data; USGS 10-meter digital elevation model-based terrain analysis.

### 4.6.3 Road-Stream Proximity and Hydrologic Connectivity

The proximity of a road to a stream strongly influences the potential impact of that road on sediment transport and delivery to the stream channel. Roads and trails increase hydrologic connectivity by serving as direct conduits of water and sediment. Approximately 20 miles of roads and trails in the Clear Creek/Kings Canyon landscape analysis area fall within Riparian Conservation Areas (RCAs), resulting in an average density greater than 50 miles per square miles of RCAs (Table 4-18). Unimproved roads (Type 6) make up over half of these roads or trails in RCAs, with approximately 11 miles. According to this criterion, the Clear Creek subarea has the greatest density of roads in RCAs (34.7 miles per square mile of RCA), suggesting that the roads in this subarea have the greatest potential to deliver sediment to streams. This factor, combined with Clear Creek

watershed's road density on areas with relatively high vulnerability for erosion may account for the adverse effects of roads on sedimentation, documented in PBS&J (2003). Kings Canyon has 11.1 miles per square mile of RCA, followed by Voltaire Canyon with 6.7 miles per square mile of RCA (Table 4-18).

Another watershed indicator used to evaluate the relative potential for roads-related sedimentation is the number and condition of road-stream and trail-stream crossings in an area (Costick 1996). Stream crossing data are unavailable for the Clear Creek/Kings Canyon landscape analysis area. Road-stream and trail-stream intersections, determined in GIS as predicted stream crossings, were used to approximate the relative number of stream crossings in each landscape analysis subarea (Table 4-19). Of the 77 road-stream and trail-stream intersections identified in GIS, 56 occur in the Clear Creek area (for a density of stream crossings per square mile of 3.5). This result lends further support to the importance of roads in the sedimentation dynamics of Clear Creek. Kings Canyon has 14 intersections (2.2 intersections per square mile), and Voltaire Canyon has seven (1.8 intersections per square mile) (Table 4-19). Most predicted stream crossings occur on National Forest lands (33 intersections), followed by private lands (29 intersections).

Several sections of Clear Creek Road above the closed gate have washed out. The Kings Canyon Road is no longer passable to vehicles because of washouts and the loss of the roadbed. The section on National Forest System lands was repaired, but there is a washout of the road on private land (S. Champion, personal communication 2003).

## **4.7 Cultural Resources**

Human use of the Sierra Nevada and Carson Range over the centuries has transformed into a diverse cultural setting. Anthropological research and physical evidence in the form of prehistoric or historic archaeological sites and traditional cultural properties chronicle the patterns of human land use and reconstruct the retrospective landscape setting. The Clear Creek/Kings Canyon landscape analysis area is located in a relatively high sensitivity zone for historic heritage resources and low sensitivity zone for prehistoric sites.

Currently, approximately 2,700 acres have been extensively surveyed for heritage resources in the Clear Creek/Kings Canyon landscape analysis area. There are 58 historic archaeological sites and one isolated prehistoric site that have been identified and formally recorded. The density for historic and prehistoric sites in the surveyed area is 14 sites per square mile. Table 4-20 lists the recorded heritage resources for the surveyed areas within the landscape analysis area.

The historic sites are associated with historical land use since the 1850s. The Spooner Summit area is an important archaeological zone in the analysis area and contains a complex of historic roads, logging flumes, recreation sites, domestic animal grazing areas, artifacts, and historic features relating to the Comstock era and post-Comstock era. Significant recorded sites include portions of the Clear Creek Flume/Spooner Summit Complex and Kings Canyon Road and the Swift's Station. All are deemed eligible for the National Register of Historic Places (NHRP) (T. Birk, personal communication 2003). The Nevada State Historic Preservation Office has recently expressed enthusiasm for funding projects for the Kings Canyon Road. Another important site is the Rufus Walton Toll Road, which has not yet been thoroughly researched. The assemblage of heritage resources in the landscape analysis area exhibits attributes that make it suitable as an historic district.

**Table 4-18. Lengths and Densities of Roads and Trails (by Type) in RCAs for Clear Creek/Kings Canyon Landscape Analysis Area**

Road or Trail Type	Clear Creek		Kings Canyon		Voltaire Canyon		Landscape Analysis Area	
	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )	Length (mi)	Density (mi/mi <sup>2</sup> )
1-Primary Highway	1.5	3.99	0	0	0	0	1.5	3.99
3-Improved, Paved	2.4	6.46	0.9	2.53	0	0	3.4	9.00
5-Improved, Dirt	2.3	6.16	0.3	0.84	0	0	2.6	7.01
6-Unimproved	6.3	16.81	1.7	4.61	2.5	6.57	10.5	28.00
7-Unimproved, 4WD	0.2	0.47	1.0	2.59	0.1	0.15	1.2	3.21
Trail	0.3	0.75	0.2	0.51	0	0	0.5	1.26
Total	13.0	34.65	4.2	11.09	2.5	6.73	19.7	52.46

Map 2-3 shows RCAs and Map 4-4 shows roads in the landscape analysis area. Densities were calculated by dividing the length of roads in RCAs by RCA areas.

Source: Humboldt-Toiyabe National Forest GIS data.

**Table 4-19. Number and Density of Road- and Trail-Stream Intersections by Land Ownership in Clear Creek/Kings Canyon Landscape Analysis Area**

Name	Carson City		Mixed		National Forest		Private		State		Landscape Analysis Area	
	No. of Crossings	Crossing Density (per mi <sup>2</sup> )	No. of Crossings	Crossing Density (per mi <sup>2</sup> )	No. of Crossings	Crossing Density (per mi <sup>2</sup> )	No. of Crossings	Crossing Density (per mi <sup>2</sup> )	No. of Crossings	Crossing Density (per mi <sup>2</sup> )	No. of Crossings	Crossing Density (per mi <sup>2</sup> )
Clear Creek	0	0	5	0.3	23	1.4	22	1.4	6	0.4	56	3.5
Kings Canyon	4	0.6	0	0	4	0.6	6	0.9	0	0.0	14	2.2
Voltaire Canyon	0	0	0	0	6	1.6	1	0.3	0	0.0	7	1.8
Landscape Analysis Area	4	0.2	5	0.2	33	1.3	29	1.1	6	0.2	77	2.9

Source: Humboldt-Toiyabe National Forest GIS data.

**Table 4-20. Recorded Heritage Resources for Surveyed Areas within Clear Creek/Kings Canyon Landscape Analysis Area**

Resource Type	Number of Sites	Description
Historic	6	Aspen Art (Basque)
Historic	23	Habitation structure/ foundation remains and trash scatter
Historic	5	Roads/flume network
Historic	1	Hotel foundation remains and trash scatter
Historic	2	Mill remains and trash scatter
Historic	20	Historic trash scatters, one railroad remains/trash scatter
Prehistoric	1	Isolated find (lithic)

Natural environmental processes and current human activities continuously affect heritage resources sites. For instance, erosion and vehicle traffic have affected rock features along Kings Canyon Road, and OHV use has impacted portions of Swift's Station remains (T. Birk, personal communication 2003). It is conceivable that historical land use-related disturbances (e.g., logging, grazing, mining, roads, and development) have damaged prehistoric sites in the landscape analysis area, which may account for the low abundance of recorded prehistoric sites. Wildland fires, prescribed fires, and wildfire suppression activities pose potential threats to heritage resources on the ground surface (Communicator's Guide 2003; Hanes 2001). Wildfires could affect subsurface artifacts if they lie under the duff layer or near burning roots. Controlled prescribed fire effects may be minimal compared to damage from wildfires. Wildfires burn with intense temperatures and tend to destroy or damage historic remains, such as melt glass or metal artifacts, consume organic material, and burn structural remains (habitation/flume). Extreme temperatures from wildfires can interfere with artifact dating techniques and potentially cause prehistoric lithic material to crack and spall (Communicator's Guide 2003; Hanes 2001). Additional potential effects of wildland fires include the use of mechanical equipment (e.g., backhoes and trucks), construction of fire lines, and ground surface exposure in a burnt area can increase visibility of surface artifacts leaving them susceptible to looters.

Archaeological, ethnographical, and historic research suggests that the Washoe people used the natural resources in the region for centuries. The Washoe subsistence base was focused on obtaining resources during seasonal rounds, such as the use of Lake Tahoe's shoreline and small streams for fishing in the summer, the gathering of pine nuts on the eastern slopes in the fall, and using lowlands or meadows in the winter. Unidentified prehistoric sites probably exist in unsurveyed portions of the Clear Creek/Kings Canyon landscape analysis area, especially along streams or creeks, in meadows, or within the pinyon-juniper woodlands. Although few prehistoric sites have been identified and formally recorded, the Washoe people have strong traditional ties to the analysis area. The Washoe currently practice traditional subsistence, plant gathering, and religious activities on their ancestral lands, and consider the Clear Creek area important culturally and environmentally.

Of the 58 formally recorded historic sites in the Clear Creek/Kings Canyon landscape analysis area, only a few have been evaluated for the NHRP. The region's contemporary landscape setting is a reflection of historical human settlement patterns and land uses over a long period of time. Heritage resources in the analysis area can continually contribute to scientific studies and interpretations on



human history and use of the area. Furthermore, the area is still utilized by native people who have traditional cultural ties to the lands.

## **4.8 Law Enforcement**

Residents in the Clear Creek/Kings Canyon landscape analysis area, especially those who reside in Kings Canyon, are concerned about activities on National Forest System lands near their homes. Activities concerning the residents include late-night outdoor parties, trash dumping, and illegal campfires. The current law enforcement presence has not been adequate to address these problems in Kings Canyon. OHV use in unauthorized areas is also a problem in the analysis area, especially in Voltaire Canyon. To the extent possible, the OHV specialist at the Carson Ranger District monitors the Voltaire Canyon area every two weeks. The HTNF has a cooperative law enforcement agreement with the Douglas County Sheriff's Department. However, much of the nuisance-activity has been reported on the National Forest System lands within Carson City.

Law enforcement needs in the Clear Creek/Kings Canyon landscape analysis area include increased patrol of areas where illegal activities recur regularly, generally on National Forest System lands within Carson City. Increased patrolling would assist the USFS to enforce the existing laws and regulations governing conduct on National Forest System lands. Enforcing the rules and fining the lawbreakers are necessary activities if illegal behaviors within the Forest System lands are to be controlled.

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## CHAPTER 5. DESIRED CONDITIONS

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The purpose of the EAWS Step 4 (Reference Conditions) is to explain how ecological conditions have changed over time as a result of human influences and natural disturbances. However, in the Clear Creek/Kings Canyon landscape analysis, the purpose of Chapter 5 (EAWS Step 4) is to describe the desired conditions relevant to the issues and key questions. Identification of desired conditions (or target conditions) is an integral component of ecosystem management. Desired conditions are portrayals of land or resource conditions that are expected to result if planning goals and objectives are fully achieved (Manley and others 1995). They can be used to develop management directions and relevant practices for landscape ecosystem conditions that will meet management plan objectives. Desired conditions have been defined in the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a) and Toiyabe National Forest Plan (USDA Forest Service 1986).

### 5.1 Sierra Nevada Forest Plan Amendment-related Desired Conditions

Desired future conditions (also referred to as management strategies, goals, and objectives) from the Sierra Nevada Forest Plan Amendment are described below, mostly verbatim, for the Clear Creek/Kings Canyon landscape analysis. Mapped and unmapped land allocations-related standards and guidelines are presented in the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a).

#### 5.1.1 Old Forest Ecosystems and Associated Species

*(Source: Appendix A in USDA Forest Service 2001a)*

The old forest and associated species conservation strategy aims to provide environmental conditions that are likely to maintain viable population of old forest associated species, most specifically the California Spotted Owl, well-distributed across Sierra Nevada National Forests. A landscape-scale strategy of land allocations, combined with stand-level management standards and guidelines, to conserve old forest ecosystems and their associated wildlife species was adopted for the Sierra Nevada. The landscape strategy will accomplish the following at multiple spatial scales:

1. Protect and manage old forest emphasis areas to provide high-quality California spotted habitat,
2. Protect and manage spotted owl home range core areas to provide moderate to high levels of tree canopy cover,
3. Manage general forest areas to maintain and increase amounts of suitable spotted owl habitat,
4. Protect all patches larger than 1 acre of high quality old forest characterized by large trees and high canopy closure, and

5. Address fire hazard and risk by strategically locating fuels treatments in the urban wildland intermix zones and in old forest emphasis areas characterized by high hazard and risk.

The ecosystem strategy also includes land allocations and related standards and guidelines for old forest emphasis areas, PACs (e.g., California spotted owl, northern goshawk, and great gray owl), forest carnivore den sites, riparian conservation areas, inventoried roadless areas, and wilderness areas that will provide landscape-scale habitat for old forest associated species.

### **5.1.2 Aquatic, Riparian, and Meadow Ecosystems**

#### **Aquatic Management Strategy Goals for Sierra Nevada National Forests**

*(Source: Appendix A in USDA Forest Service 2001a)*

1. **Water Quality:** Maintain and restore water quality to meet goals of the Clean Water Act and Safe Drinking Water Act, providing water that is fishable, swimmable, and suitable for drinking after normal treatment
2. **Species Viability:** Maintain and restore habitat to support viable populations of native and desired non-native plant, invertebrate, and vertebrate riparian-dependent species. Prevent new introductions of invasive species. Where invasive species are adversely affecting the viability of native species, work cooperatively with appropriate State and Federal wildlife agencies to reduce impacts to native populations.
3. **Plant and Animal Community Diversity:** Maintain and restore the species composition and structural diversity of plant and animal communities in riparian areas, wetlands, and meadows to provide desired habitats and ecological functions.
4. **Special Habitats:** Maintain and restore the distribution and health of biotic communities in special aquatic habitats (such as springs, seeps, vernal pools, fens, bogs, and marshes) to perpetuate their unique functions and biological diversity.
5. **Watershed Connectivity:** Maintain and restore spatial and temporal connectivity for aquatic and riparian species within and between watersheds to provide physically, chemically, and biologically unobstructed movement for their survival, migrations and reproduction.
6. **Floodplains and Water Tables:** Maintain and restore the connections of floodplains, channels, and water tables to distribute flood flows and sustain diverse habitats.
7. **Watershed Condition:** Maintain and restore soils with favorable infiltration characteristics and diverse vegetative cover to absorb and filter precipitations and to sustain favorable conditions of stream flows.

8. **Streamflow Patterns and Sediment Regimes:** Maintain and restore in-stream flows sufficient to sustain desired conditions of riparian, aquatic, wetland, and meadow habitats and keep sediment regimes as close as possible to those with which aquatic and riparian biota evolved.
9. **Stream Banks and Shoreline:** Maintain and restore the physical structure and condition of stream banks and shorelines to minimize erosion and sustain desired habitat diversity.

## **Riparian Conservation Objectives (RCOs) for Sierra Nevada National Forests**

*(Source: Appendix A in USDA Forest Service 2001a)*

**RCO #1:** Ensure that identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.

**RCO #2:** Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.

**RCO #3:** Ensure a renewable supply of large down logs that: (1) can reach the stream channel and (2) provide suitable habitat within and adjacent to the Riparian Conservation Area.

**RCO #4:** Ensure that management activities, including fuels reduction actions, within Riparian Conservation Areas and Critical Aquatic Refuges enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.

**RCO #5:** Preserve, restore, or enhance special aquatic features, such as meadows, lakes, ponds, bogs, fens, and wetlands, to provide the ecological conditions and processes needed to recover or enhance the viability of species that rely on these areas.

**RCO #6:** Identify and implement restoration actions to maintain, restore or enhance water quality and maintain, restore, or enhance habitat for riparian and aquatic species.

## **Riparian Conservation Areas**

Riparian conservation areas (RCAs) along streams and around waterbodies will be established as land allocations to: (1) preserve, enhance, and restore habitat for riparian- and aquatic-dependent species; (2) ensure that water quality is maintained or restored; (3) enhance habitat conservation for species associated with the transition zone between upslope and riparian areas; and (4) provide greater

connectivity within the watershed. RCAs are delineated and managed consistent with riparian conservation objectives.

### 5.1.3 Fire and Fuels

*(Source: Appendix A in USDA Forest Service 2001a)*

Fire and fuels management relies on a combination of four primary strategies for modifying wildland fire behavior and re-introducing fire across broad landscapes:

- strategically placed area treatments,
- wildland fire use,
- defensible fuels profile zones adjacent to communities and areas of high value, and
- priority-setting mechanisms established in the national Cohesive Fire Strategy.

The urban wildland intermix zone receives the highest priority for fuels treatment. Fuel treatments in the urban wildland intermix defense zone (an inner ¼-mile wide buffer) will be the most intense, designed to prevent the loss of life and property by creating defensible space. Fuel treatments in the urban wildland intermix threat zone (an outer 1 ¼ -mile wide buffer) will be strategically located to interrupt wildland fire spread and reduce fire intensity. Fuel treatments that occur outside the threat zone will be designed to support treatment in the threat zone, to protect resources at risk, and to reintroduce fire into fire-dependent ecosystems. This may involve mechanical and/or prescribed fire treatments.

Management direction for urban wildland intermix zones is to:

- design fuel treatments to provide a buffer between developed areas and wildlands;
- design and distribute treatments to increase the efficiency of firefighting efforts and reduce risks to firefighters, the public, facilities and structures, and natural resources;
- determine the distribution, schedule, and types of fuel reductions treatments through collaborations with local agencies, air regulators, groups, and individuals; and
- place the highest density and intensity of treatments in developed areas within the urban wildland intermix zone.

Within the urban wildland intermix zone, areas are treated to move toward or maintain the following desired conditions

- Fuel conditions allow for efficient and safe suppression of all wildland fire ignitions. Fires are controlled through initial attack under all but the most severe weather conditions.
- Under high fire weather conditions, wildland fire behavior in treated areas is characterized as follows: (1) flame lengths at the head of the fires are less than four feet; (2) the rate of spread at the head of the fire is reduced to at least 50 percent of



pre-treatment levels for a minimum of five years; (3) hazards to firefighters are reduced by keeping snag levels to two per acre (outside of California spotted owl and Northern goshawk PACs and forest carnivore den site buffers); and (4) production rates for fireline construction are doubled from pre-treatment levels.

Fuel treatments will also be emphasized in PACs, old forest emphasis areas, and California spotted owl home range core areas. Mechanical treatment will be allowed in areas when prescribed burning is determined to have: (1) a high likelihood for prescribed fire escape due to excessive fuel accumulations; (2) a high potential for unacceptable smoke impacts; or (3) a high risk for prescribed fire to result in canopy structure loss due to excessive surface and ladder fuels. Mechanical treatments could remove surface and ladder fuels up to 20 inches in diameter in stands in these areas. Lightning-cause wildland fires will be used when permitted by approved fire management plans (including smoke management) to achieve natural resource management objectives.

#### **5.1.4 Noxious Weeds**

*(Source: Appendix A in USDA Forest Service 2001a)*

The USFS will work cooperatively with State and local agencies to prevent the introduction and establishment of noxious weed infestations and to control existing infestations. The USFS will conduct noxious weed inventories and risk assessments as part of project planning. Noxious weed management practices will be consistent with the Regional Noxious Weed Management Strategy and the USFS Manual (FSM 2081.2) management direction pertaining to integrated weed management. The management direction for an integrated weed management approach is as follows: (1) Priority 1– Prevent the introduction of new invaders; (2) Priority 2– Conduct early treatment of new infestations; and (3) Priority 3– Contain and control established infestations.

## **5.2 Toiyabe National Forest Plan-related Desired Conditions**

Desired conditions from the Toiyabe National Forest Plan (USDA Forest Service 1986) are described below, verbatim, for the Clear Creek/Kings Canyon landscape analysis. Forest-wide management goals and associated standards and guidelines related to these desired conditions are presented in the Toiyabe National Forest Plan.

Key resource values in the Carson Front are watershed, wildlife, visuals, and dispersed recreation. Management emphases on National Forest System lands in the Carson Front is to protect key resource values and property from wildfire and manage to provide a diversity of recreational opportunities (e.g., roaded natural experiences along the U.S. Highway 50 corridor and Semi-Primitive Motorized and Non-Motorized experiences in other areas). Vegetation management will be conducted to enhance soil, water, wildlife, and aesthetic values, and to minimize the potential for catastrophic wildfires, and insect and disease infestations.

### **5.2.1 Recreation**

*(Source: USDA Forest Service 1986)*

The Forest will offer a variety of opportunities for developed and dispersed recreational experiences. Existing and newly developed sites will operate to Forest Plan standards and guidelines. Expected demand for developed recreation will be met. Construction/ reconstruction of trail and trailheads may have been modified based on planned comprehensive trail inventories. Trails will be maintained at a one- to five-year frequency depending on management objectives. Increased protection of resources and recreational users will have been provided through improved law enforcement. Facility maintenance will have been increased and all developed recreation improvements will be maintained at a safe and healthy standard.

Off-road vehicle (ORV) use will be allowed where such use is not incompatible with other resource programs. An annual travel plan will be developed for each Ranger District. Generally the Forest will be open to ORVs. Closure or restrictions will occur where there is obvious conflict with other uses and where natural resource damage might result. Forest resources will not have been degraded from indiscriminate ORV use.

### **5.2.2 Visual Management**

*(Source: USDA Forest Service 1986)*

The Forest's landscape will have been managed to achieve the following VQOs:

- (1) Preservation—where only ecological changes have occurred;
- (2) Retention—management practices are not evident to the casual observer;
- (3) Partial Retention—management practices are visually subordinate (to the natural landscape);
- (4) Modification— management practices may have dominated the landscape but activities should appear as natural occurrences in the fore- and middle-ground;
- (5) Maximum Modification—management practices may have dominated the landscape but activities should appear as natural occurrences in the background.

### **5.2.3 Fire and Fuel Management**

*(Source: USDA Forest Service 1986)*

Fire and fuel management will have been implemented at a level that achieved the least cost plus least net value change on all management areas, except those where management direction required a more intense level of protection. The Cooperative Sierra Fire Initiative will have been implemented. Level II and the Sierra Initiative will result in an average annual burn of a maximum of 500 acres by wildfire and improved protection of private land investments within and adjacent to the Forest. Prescribed burning will have been used in wildlife and range management practices resulting in improved vegetative conditions.

### 5.2.4 Soil, Water, and Riparian Areas

*(Source: USDA Forest Service 1986)*

Greater emphasis on environmental quality will have had positive effect on the soil and water resources. Specific riparian area standards and guidelines, and greater emphasis on rangeland management will have significantly benefited riparian area-dependent resources. Direct soil and water resource improvement projects will have arrested the decline and, in some instances, restored the productivity of key watersheds. Instream flows will protect riparian area-dependent resources against incompatible water resource development. Use of Forest-wide resource inventory and greater emphasis on water resource inventory will have resulted in greater project success, less impact on soil and water resources, and avoidance of losses from management activities in hazardous areas such as floodplains. Monitoring will provide information for quicker response to management-induced impacts on soil and water resources. Knowledge to properly implement projects will also be gained from continued monitoring. Water yields will not have increased on the Forest.

### 5.2.5 Wildlife and Fish

*(Source: USDA Forest Service 1986)*

Habitat conditions for the bald eagle and peregrine falcon will have been maintained. Management of habitat for management indicator species, sensitive species, fish, and big game species will have been emphasized. Riparian habitats will have been improved by emphasizing their protection and restoration. Use of the Forest snag management and old growth standards and guidelines will have maintained forested habitats for non-game and ecologically important species. Sensitive plant species will be protected. The Toiyabe National Forest will have continued to work with other agencies, particularly the Nevada Department of Wildlife and the California Department of Fish and Game, to determine what opportunities exist for habitat management.

### 5.2.6 Cultural Resources

The desired future condition for cultural resources will be written in the Cultural Resource Overview (per the direction in the Forest Plan, USDA Forest Service 1986). This document will guide the management direction related to cultural resources and will provide a link to the Nevada State Historic Preservation Plan. The Overview will delineate areas for moderate and high archaeological sensitivity, and guide work targeted for completion in a Forest-wide cultural resource inventory. It will also nominate sites for the NHRP and define historic districts. In addition, compliance with the National Historic Preservation Act (1966, as amended) requires completion of a Section 110 plan, which will describe enhancement or interpretation of heritage resource values. For example, the Section 110 plan includes managing NRHP site and historic districts by signing, developing public interpretation programs, and creating brochures. The Cultural Resource Overview and the Section 110 plan are under development (T. Birk, personal communication 2003).

### **5.2.7 Integrated Pest Management**

*(Source: USDA Forest Service 1986)*

Endemic populations of bark beetles and other Forest pests will continue but with a reduction in acres affected by dwarf mistletoe. Noxious farm weeds and significant outbreaks of range pests will be treated as necessary.

### **5.2.8 Transportation System**

*(Source: USDA Forest Service 1986)*

The transportation system will provide user safety, convenience, and efficiency to accomplish land and resource management objectives. Resource activities will be coordinated with road construction. The basic arterial and collector road system will be in place, and will be a standard that is maintainable for safe travel by a prudent driver in a passenger car. Traffic may be restricted on roads not constructed to an all-weather standard. All other construction and reconstruction will be in support of resource activities. Campground and administrative site roads will be maintained at least to a level that is safe for travel in a standard passenger car. Maintenance levels for local roads will have been documented in the Forest Transportation Facility Operation and Maintenance Schedule.

### **5.2.9 Law Enforcement**

*(Source: USDA Forest Service 1986)*

The public will be educated in proper use of the Forest. Timber theft, arson, fraudulent leasing of range privileges, mining abuses, and vandalism will be minimal. Violations will be reported and proper action taken.

## **5.3 Other Management Directions**

The USFS's Road Management Policy (USDA Forest Service 2001c) has the following four major components:

- Address both the access benefits and the ecological costs of roads;
- Give priority to reconstructing and maintaining needed roads and decommissioning unneeded roads or, where appropriate, convert the roads to less costly and other more environmentally beneficial uses;
- Use a science-based roads analysis in an open public process when road management decision may have ecological or socio-economic effects; and
- Add new roads only where resource management objectives and benefits have been documented and where long-term funding objectives have been carefully considered.

The HTNF completed a Forest-wide roads analysis and planning process in 2003 (USDA Forest Service 2003c). The road management objectives (RMOs) for Kings Canyon Road and Voltaire

Canyon Road have been incorporated into this landscape analysis (see Appendices H-1 and H-2). RMOs define the intended purpose of an individual road based on management area direction and access management objectives.

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## **CHAPTER 6. SYNTHESIS AND INTERPRETATIONS**

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The purpose of Chapter 6 (EAWS Step 5) is to review information presented in previous chapters and provide synthesis and interpretations in an integrative framework. Emphasis is placed on the understanding of ecosystem processes and functions as they relate to the issues and key questions in Chapter 3 and on the identification of opportunities to bridge the gap between current and desired ecosystem conditions. The synthesis and interpretations discussion includes the following: (1) key findings on current and desired conditions and associated trends/patterns and causal mechanisms; (2) potential risks or threats to key ecosystem components and processes; and (3) possible management practices, based on ecosystem capability, to achieve key management objectives or desired resource conditions.

It should be noted that some key questions are simultaneously addressed in integrated discussions, so a separate response to each key question may not be found.

### **6.1 Upland Ecosystem Conditions**

#### **6.1.1 Vegetation, Disturbance Dynamics, and Fire Regimes**

Prior to the 1860s, wildfire probably was the largest single disturbance agent, except for changes in climate, in shaping the landscape condition. Pre-European settlement vegetation conditions have been modified on National Forest System lands and adjacent lands in the Carson Range as a result of changes in land use (e.g., timber harvesting and livestock grazing), wildland fire-related disturbance regime, introduction of exotic species by human settlement, and climatic variability. During the European settlement and federal land ownership periods, fire suppression altered the historical natural fire regimes on the landscape, especially in pine and mixed conifer forest types in the montane vegetation zone. Fire suppression, timber harvesting, and livestock grazing combined have resulted in the departures of vegetation attributes and fuels from historical ranges, and the emergence of an altered landscape pattern.

Site-specific background information on historical fire regimes (based on historical fire patterns) by vegetation types are unavailable to evaluate in detail the changes in vegetation attributes as a result of the altered wildland fire regimes.

#### **Montane Forest**

Forest conditions have changed within the Clear Creek/Kings Canyon landscape analysis area over the past 150 years. Tree species composition and stand structure (tree density and crown cover) have shifted. Past timber harvest and fire suppression have been the primary causes of this change in current cover type and forest density. In the 1860 to 1870s, nearly all the forested areas within the landscape analysis area were logged to support Comstock era mining. Subsequent fire suppression has reduced the fire return interval within the montane forest cover type.

Historical fire regimes in the montane forest of the Carson Range were characterized by frequent, but generally less severe, fires. The historical fire regime in the pine and mixed conifer forest types favored Jeffrey and ponderosa pines over white fir, especially in the lower elevations (USDA Forest Service 1997). Where fire has been frequent historically, the absence of periodic low intensity surface

fire allows relatively rapid changes in vegetation composition and structure. The changed forest conditions often become the predisposing factors to epidemic insects and disease outbreaks, increased dead and down fuel loading, shade tolerant species in the understory, and severe stand replacement fires. A moist climate pattern favorable to the establishment of white fir seedlings and livestock grazing may also have influenced vegetation composition and structure (Gruell 2001; USDA Forest Service 1993a).

Past timber harvesting, fire suppression, grazing, and climate change contributed to the more densely stocked and even-aged stands than those of the pre-Comstock era, especially in the Jeffrey pine and Jeffrey pine/white fir forest types. Stand density was reduced over portions of the upper Clear Creek forested area through insect mortality and subsequent salvage logging in the mid-1990s. Existing surface fuels are relatively high within portions of the salvaged area because of the large quantity of deadfall and remaining logging residue.

In Jeffrey pine/ponderosa pine and Jeffrey pine/white fir forests, the fire regime has changed from frequent, low-intensity fire to moderate frequency, low- to-high-intensity fire. Where tree density and understory vegetation have increased in Jeffrey pine/ponderosa pine forests, classified as fire regime condition class 1–2 (from Table 4-4), the stands now have a low to moderate risk of losing ecosystem values, including tree mortality, soil productivity, watershed resources, wildlife habitat, and public and firefighter safety. In the Jeffrey pine/white fir forests, classified as fire regime condition class 2–3 (from Table 4-4), risk to loss of ecosystem values and danger to public safety is moderate to high.

Exclusion of periodic, low-intensity fires in riparian and aspen cover types is trending these vegetation communities toward conifer species dominance. Aspen primarily regenerates by clones after disturbance such as wildland fire. Without periodic disturbance, aspen will be lost or diminished within the riparian and aspen-dominated vegetation communities.

### **Mountain Shrubland**

Mountain shrub cover type is extensive in the central portion of the Clear Creek and Kings Canyon subareas of the Clear Creek/Kings Canyon landscape analysis area. Mountain shrubland covers approximately 17.6 percent (2,974 acres). These shrublands are thought to have historically supported ponderosa pine and Jeffrey pine trees with shrub understory. The pine trees were logged during the Comstock era in the 1860 to 1870s. The logged-over areas are thought to have burned intensely in the 1920s, the fires fueled extensively by logging slash. Only a small extent of the current mountain shrub cover type has burned in the past 35 years, creating dense brush fields in the landscape analysis area. Relatively infrequent stand replacement fires describe the historical and current fire regimes for the mountain shrub cover type that currently dominates this area.

### **Sagebrush/Bitterbrush, and Grassland**

The majority of fires that have occurred in the past 35 years have burned in sagebrush/ bitterbrush and grassland cover types within the Clear Creek/Kings Canyon landscape analysis area. Since fire history record keeping began in 1968, approximately 71 percent (based on area burned in acres) of the wildfire occurrence has been in the sagebrush/ bitterbrush and grassland cover types. The results of these periodic fires are a relatively low fuel hazard in the lower elevations brush and grasslands within the analysis area. The three wildfires that burned in 2003 covered approximately 668 acres of



the landscape analysis area, which effectively reduced the fuel hazard in the lower portions of Clear Creek and Voltaire Canyon subareas. Fire regime condition class 1 describes most of the sagebrush and bitterbrush cover types.

Sagebrush shrub communities are threatened by the invasion of cheatgrass, an exotic Russian brome, in some areas in the lower elevations. Cheatgrass and non-native plants invasions potentially alter natural fire cycles (with more frequent fires) and vegetation patterns (with elimination of sagebrush and native grasses) in sagebrush shrub community (Paige and Ritter 1999). Cheatgrass dominance creates a bed of continuous, fine fuel that readily carries fire. Where cheatgrass is well established, its flammability may produce a permanently shortened fire cycle with repeated, frequent fires (Billings 1990).

### **6.1.2 Wildfire Risk and Hazard**

Fire risk is defined as the probability of fire ignition. Hazard is defined as a fuel condition (fuels available to maintain and spread a fire) or state (vegetative and topographical features affecting intensity and rate of spread) that may result in an undesired wildfire event.

Landscape-level wildland fire and fuels management strategies are needed to reduce hazardous fuels, modify existing forest fire pattern, and improve fire-dependent forest ecosystems to meet the management objectives for National Forest System lands. The Sierra Nevada Forest Plan Amendment provides standards and guidelines for vegetation and fuel treatments, including both mechanical thinning and prescribed fire. These standards and guidelines apply to the network of land allocations on National Forest System lands and are designed to modify the fire behavior (reduce large, uncharacteristically severe wildland fires) and re-introduce fire across broad landscapes (USDA Forest Service 2001a).

#### **Fire Risk**

Each year, on average, six to eight lightning-caused fire ignitions occur within the upper Clear Creek and Kings Canyon areas (K. Martin, personal communication 2003). In the past, wildfires did not spread, as a result of the rapid response of the fire fighters.

Larger wildfires that have burned within the Clear Creek/Kings Canyon landscape analysis area have occurred predominately in the lower elevation sagebrush/bitterbrush cover types. Approximately 54 percent of the fires that have burned four acres or more within the analysis area are known to be human-caused fire ignitions. Often, these fires occurred under extreme fire weather conditions (e.g., hot, dry and windy). The increased human settlement and development within the urban wildland intermix zone, combined with a high chance of human-caused fire ignitions, suggest that more human-caused wildfires may be expected.

#### **Wildfire Hazard Classification**

For the Clear Creek/Kings Canyon landscape analysis area, a relative hazard screening/rating approach was used to characterize the fuel and slope hazards. Vegetation-fuel models were used to classify the fuel hazard, an indicator of predicted surface fire behavior. The relationship between fire behavior and slope gradient was used to classify the wildfire hazard. For example, the steeper the slope, the faster the fire spreads because the fire heats and dries the upslope fuels. Based on the combination of fuel models and slope classes, a relative hazard rating of high, moderately high,

moderate, or low was assigned to areas within the Clear Creek/Kings Canyon landscape analysis area (see Table 6-1). In some cases, a high hazard rating reflects vegetation types that have shifted from historically low-severity fire regimes to moderate- or high-severity fire regimes due to increased fuel loads or stand density.

**Table 6-1. Fuel Types and Slope Classes-based Relative Hazard Rating\* for the Clear Creek/Kings Canyon Landscape Analysis Area**

Fuel Type/Cover Type	Slope Class (%)		
	0-20	21-40	>40
FM1- Short grass	Moderate	Moderately High	Moderately High
FM2- Timber (grass and understory)	Moderate	Moderately High	High
FM4- Chaparral (6 feet)	Moderately High	High	High
FM6- Dormant shrub and hardwood	Moderate	Moderately High	High
FM8- Closed timber litter	Low	Low	Low
FM10- Conifer (litter and understory)	Moderately High	High	High
FM99- Misc.	Not applicable	Not applicable	Not applicable

\* Wildfire Hazard Classification by USFS (R. Shaw) and Tetra Tech FW, Inc. (J. Urbanski and M. Pious) in 2003.

Approximately 70 percent of the area within the Clear Creek/Kings Canyon landscape analysis area is classified as high hazard (see Map 6-1). In the western portion of the analysis area, high hazard is related to dense montane forest conditions. In the central portion of the analysis area, large areas of mountain shrublands contribute to high hazard. In the eastern portion of the analysis area, recent fires have reduced much of the high hazard rating for this area. The downgrading of the high hazard rating is not reflected in Map 6-1. Higher hazard areas are interspersed with lower hazard areas in the eastern portion of the analysis area. High and moderately high hazards in this area are associated with sagebrush/bitterbrush cover type on steep slopes.

Detailed stand-level vegetation types, structure attributes, and fuel density information are not available for the Clear Creek/Kings Canyon landscape analysis area. Landsat<sup>TM</sup>-based vegetation classifications from the Nevada GAP data (1996) were used to crosswalk the vegetation cover types to fuel models (see Table 4-7 and Map 4-2). A GIS-based Digital Elevation Model (DEM) was used to derive the slope gradients (see Map 4-7). This analysis recognizes the potential omission and commission errors in the vegetation/land-cover type classification and the subsequent crosswalk to vegetation-fuel type classes. Detailed vegetation type and structure information are required for appropriate fuels characterization in wildfire hazard evaluations. Field verification and mapping of vegetation and fuels (including cover type, structural stage, canopy closure, crown height and density, fuel types and density, and fuel moisture) are necessary for fire and fuels management planning.

### Urban Wildland Intermix Zone and Wildfire Risk/Hazard

Based on the Sierra Nevada Forest Plan Amendment land allocations, almost all of the lands within the Clear Creek/Kings Canyon landscape analysis area are classified as urban wildland intermix zone (either defense or threat zone) (see Map 2-3). The Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a) states that hazardous fuels reduction in areas of high wildfire hazard and risk should occur in the following treatment priority order: (1) urban wildland intermix zone, (2) old

forest emphasis areas where fire hazard and risk is greatest, (3) sensitive species habitats, and (4) general forest.

In the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a), fire and fuels management relies on a combination of four primary strategies for modifying wildland fire behavior and re-introducing fire across broad landscape. The strategies include: (1) strategically placed area treatment (SPLATs), (2) wildland fire use, (3) defensible fuels profile zones adjacent to communities and areas of high value, and (4) priority-setting mechanisms established in the national Cohesive Fire Strategy (USDA Forest Service 2002a). The SPLAT approach is applied across all land allocations outside urban wildland intermix fire defense zones.

### ***Fire Defense Zone***

The fire defense zone extends 0.25 mile around developed property with a density of at least one structure per 40 acres. For the Clear Creek/Kings Canyon landscape analysis area, several areas of high fuels hazard in the fire defense zone where fuels reduction treatments would provide protection to existing and pending development have been identified through field observations (R. Shaw, personal communication 2003). The *Wildfire Risk/Hazard Assessment and Risk Mitigation Plan* (Dynamac Corporation 2003a) proposed six mitigation actions and related priorities for the Clear Creek private landowners located in the urban wildland intermix fire defense zone (see Appendix I for map of proposed mitigation actions).

The eastern edge of Section 5 (T14N, R19E) lies adjacent to the proposed golf course development (the Schneider Ranch property) in an area of high fuel hazard. Future development and existing structures in this area are at risk for wildland fire moving west-southwest off the Carson Range.

A high fuel hazard exists in an area just south of U.S. Highway 50 (southeast corner of Section 33; T15N, R19E), directly west of the Nevada State Youth Center, where National Forest System land abuts Nevada state land. The construction of an underpass associated with the Schneider Ranch property development is tentatively proposed just east of the existing fire defense zone. The adjacent highway and potential construction of the underpass would effectively widen the potential area treated for hazardous fuels reduction.

Pockets of dense sagebrush exist in the fire defense zone in the northeast portion of Section 23 (T15N, R19E) in the Kings Canyon area. The opportunity to reduce brush would provide a break in the fuel continuity near existing homes adjacent to this area.

Currently, plans exist for a housing development on private land east of Airview Drive in Carson City (eastern portion of Section 19; T15N, R20E). Assessment of the wildfire hazards associated with this new development in the fire defense zone cannot be completed until design and/or construction is finished.

### ***Fire Threat Zone and Other Land Allocations***

The SPLAT approach, applied outside the urban wildland intermix defense zone, is based on strategically locating fuel treatment areas to interrupt fire spread and modify wildland fire behavior across the landscape (USDA Forest Service 2001a). The disconnected fuel treatment areas across the landscapes will function as “speed bumps” reducing the rates of fire spread, thereby reducing the size, intensity, and severity of wildland fires.

For the Clear Creek/Kings Canyon landscape analysis area, the following considerations were used to evaluate the potential layout of SPLATs: wildfire hazard rating based on fuel models and slope classes; slope aspect; prevailing wind direction; existing fuelbreaks; road access; values at risk; and best professional judgment. Values at risk refer to areas of high resource value that would take priority for protection from loss or damage due to wildland fires (e.g., old forest habitat, wildlife emphasis areas, developed recreation sites, riparian habitat, and scenic integrity). However, in the urban wildland intermix zone, human life and structures are the highest priority for protection from wildfire.

SPLATs should be oriented to the predicted direction of fire spread. In the Clear Creek/Kings Canyon landscape analysis area, SPLATs should be oriented to intercept wildland fires driven by southwest or west downslope winds off the Carson Range as much as possible. Local knowledge of forest landscape conditions and fire behavior patterns was used to refine the potential layout of the SPLATs (R. Shaw, personal communication 2003). Links to existing fuelbreaks (natural and human-created) were integrated into the design of the SPLATs. Fuelbreaks exist within and adjacent to the landscape analysis area in the southwestern portion of Clear Creek and west of the analysis area, along North Canyon Road, on Nevada state land.

The standards and guidelines outlined in the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a) should be followed for designing on-the-ground fuel treatments (both mechanical thinning and prescribed fire) to achieve the desired conditions for the Clear Creek/Kings Canyon landscape analysis area. However, these implementation guidelines may be modified to suit site-specific land capability (e.g., vegetation potential and soil productivity) and fire history and behavior to accomplish the desired landscape condition. The overall goal should be to maintain 30 to 40 percent of each landscape (outside the urban wildland intermix fire defense zone) in a condition that meets fuel management objectives. This goal can be accomplished with the SPLAT approach to reduce large, uncharacteristically severe wildland fires. In addition to the SPLAT approach, lightning-caused wildland fire can be used to reduce fuel loads or maintain and/or enhance key ecosystem components.

Priority for vegetation and fuels treatments should consider the wildfire hazard rating and values at risk. In the Clear Creek/Kings Canyon landscape analysis area, high priority areas for vegetation and fuels treatments to achieve the desired fire and fuels management objectives are the relatively high wildfire hazard areas (within or adjacent to values at risk) in pine and mixed conifer forest types within the urban wildland intermix fire threat zone. Urban wildland intermix fire defense zones would contribute to the effectiveness of vegetation and fuels treatments. Proximity to these areas is the primary consideration for prioritization of treatments for the Clear Creek/Kings Canyon landscape analysis area. Fuel treatments designed to protect existing structures in the fire defense zone are effective when supported by fuel treatments in the fire threat zone and outer areas across the broad landscape.

Priority for vegetation and fuels treatments may need to consider feasibility and cost. For example, a SPLAT may be treated in part only along the existing roads where access may allow for a lower treatment cost. Partial fuel treatments along existing roads would meet the objectives for fuel management as long as the size of the treatment area were adequate to reduce fire spread and

intensity, and the orientation of the treated area aligned with other SPLATs locations along the anticipated direction of wildland fire.

### **Feasibility and Effectiveness of Fuel Treatments**

The feasibility of implementation of hazardous fuels reduction treatments is a concern for the Clear Creek/Kings Canyon landscape analysis area. However, potential opportunities exist in the area to market small-diameter logs generated from fuel treatments on National Forest System lands. Efforts are underway to establish and promote local markets, such as the manufacture of wood pellets from the byproducts of vegetation and fuels treatments (K. Martin, personal communication 2003). The presence of a biomass-fired cogeneration plant within reasonable hauling distance may provide a potential market for the small-diameter logs from the fuel treatments. The placement of fuel treatment areas near roads and a major highway and the presence of infrastructure (adequate roads and landings) to harvest timber may reduce operational costs. Opportunities for stewardship service contracts, cooperative agreements with developers on adjacent land, and cooperative projects with other federal and state agencies are other possibilities to implement fuel treatments.

Since the Clear Creek/Kings Canyon landscape analysis area is located along a major highway between Lake Tahoe and Carson City, smoke emissions could affect air quality and would be a concern when prescribed burns are used as fuel treatments. However, under favorable smoke dispersal conditions and away from sensitive areas, prescribed fire could be used for fuel reduction treatments in this area (K. Martin, personal communication 2003). Smoke modeling tools could be used to predict smoke dispersion, and avoid burning on high visitor days. To mitigate smoke-related effects, broadcast burning activities are coordinated through the Nevada Division of Environmental Protection.

Vegetation and fuels treatments on National Forest System lands are designed to effectively modify wildland fire behavior and to mitigate the consequences of large, uncharacteristically severe wildland fires. Fire behavior research on Western forests shows that (depending on the forest type and structure attributes) the best management strategy for wildland fire hazard reduction is to manage stand tree density and species composition with well-designed silvicultural systems (preferably thinning from below, free thinning, and reserve tree shelterwoods) at a landscape scale. They recommend that treatments include a mix of thinning, surface fuel treatments, and prescribed fire with proactive treatment in areas with high risk to wildfire (Graham and others 1999).

The vegetation and fuels treatments on National Forest System lands, in conjunction with fuel reduction treatments on private landowners in the Clear Creek watershed, would reduce the risk of large, severe wildfires in the urban wildland intermix zone. Fuels treatments should be implemented on the National Forest System lands and adjacent private lands for wildfire hazard mitigation and develop a fire safe community to protect values at risk.

Detailed vegetation and fuel classification and mapping for fire applications are unavailable for the Clear Creek/Kings Canyon landscape analysis area. Without this information, using the fire behavior fuel model to compare the effectiveness of before-and-after fuel reduction treatments and changes in fire behavior is not possible.

### 6.1.3 Wildlife Habitats

Wildlife habitats discussed below include the sagebrush/bitterbrush and old forest habitats. The focal species for the sagebrush habitats is the mule deer.

The California spotted owl, northern goshawk, flammulated owl, white-headed woodpecker, and American marten are the selected focal species for old forest habitat (large trees with multi-strata or single-stratum tree canopy closure) and for the special habitat elements of dead or decadent vegetation (e.g., snags and downed wood/logs).

#### Sagebrush/Bitterbrush Habitat

In the Clear Creek/Kings Canyon landscape analysis area, shrublands are dominated by sagebrush and bitterbrush in the lowest elevations. Sagebrush cover type, in low and high elevations combined, encompasses approximately 26 percent (4,390 acres) of the analysis area. In Voltaire Canyon, sagebrush is the dominant cover type, occupying 70 percent of the area. Bitterbrush, which dominates the upper elevations of the sagebrush zone, covers approximately 6.8 percent (1,151 acres) of the analysis area. In the pinyon-juniper zone, which occurs in lower elevations above the sagebrush zone, the understory of the pinyon-juniper cover type is generally sparse with sagebrush and cool season perennial grass. Pinyon/pinyon juniper cover type is found on 3.2 percent (537 acres) of the analysis area. The fire regime condition class 1 describes most of the sagebrush and bitterbrush cover types.

Based on 35 years of fire records, the majority of the wildfire occurrences (approximately 71 percent based on area burned in acres) have been in the sagebrush/bitterbrush and grassland cover types in the lower elevations within the Clear Creek/Kings Canyon landscape analysis area. Fifty-four percent of the wildfire occurrences are known to be human-caused fire ignitions. The three wildfires that burned in 2003 covered 668 acres in the eastern portion of Clear Creek and southern portion of Voltaire Canyon within the landscape analysis area. These periodic wildfires in the lower elevations shrublands and grasslands effectively reduce hazardous fuels.

Increased development along the Carson Front Range, especially in the urban wildland intermix zone located in the foothills, combined with the effects of the periodic wildland fires have resulted in loss and degradation of sagebrush/bitterbrush habitats for mule deer. The majority of the human settlement and related development areas are located in the lowest elevations within the Clear Creek/Kings Canyon landscape analysis area. These areas overlap with the winter range for mule deer and other wildlife species.

Understanding the ecology and management of sagebrush habitat is important to provide suitable habitat for mule deer in the Clear Creek/Kings Canyon landscape analysis area. Areas with potential mule deer habitat improvement or rehabilitation opportunities overlap the lower elevation sagebrush scrub communities burned in past wildfires. The northeastern and eastern portions of Kings Canyon (an intermix of National Forest System, Carson City, and private lands), northern and southern portions of Voltaire Canyon (an intermix of National Forest System and private lands), and eastern portion of Clear Creek (an intermix of National Forest System, state, and private lands) are potential candidate areas for mule deer habitat improvement or rehabilitation.

After a fire, native plants, such as sagebrush and bitterbrush, must be reestablished by wind-borne seeds or seed bank left in the ground. Because sagebrush seeds generally fall close to the parent plant (and thus have very poor dispersal), and because bitterbrush is fire-intolerant, a relatively long time is required for these plants to reestablish themselves in burned areas, especially after large, severe wildfires. A possible management practice for habitat restoration of the fire-damaged rangelands is to seed the areas with sagebrush and bitterbrush. In recent years, NDOW completed broadcast aerial seeding of sagebrush, bitterbrush, and bluebunch wheatgrass for rehabilitating fire-damaged lands in mule deer winter range. In rangelands without frequent fire influence and with mature sagebrush stands (based on woody biomass and canopy cover), thinning could be used to increase total seed production and natural seedling recruitment.

Cheatgrass invasion may be a problem after fires, so control of the invasive plant, in conjunction with seeding for the re-establishment of sagebrush and bitterbrush in burned areas, is important. Forage kochia seed, an exotic shrub that competes with the cheatgrass, has been recently used in Nevada to allow for the reestablishment of sagebrush.

### **Old Forest Habitat**

In Clear Creek/Kings Canyon landscape analysis area, yellow pine (or Jeffrey pine/ponderosa pine) and mixed conifer (or Jeffrey pine/white fir and white fir/red fir) forests dominate the montane vegetation zone. The old forest emphasis area, a USFS-mapped land allocation (see Map 2-3), covers approximately 8.5 percent (1,437 acres) in the Clear Creek/Kings Canyon landscape analysis area, mostly limited to the western portion of the Clear Creek watershed. Mixed conifer, old forest structural stage occurs in the upper elevations of the Clear Creek watershed. A 1991 old-growth forest inventory and recent stand exam data show that old forest structural stage exists in the delineated Old Forest Emphasis Area within the Clear Creek watershed. The mixed conifer, old forest structural stage is dominated by large trees of Jeffrey pine, white fir, and red fir, with an abundant occurrence of snags and downed wood debris. The existing old forest areas received only light intensity timber harvest during the Comstock era in the mid to late 1800s.

The Clear Creek/Kings Canyon landscape analysis area currently contains one known California spotted owl territory and two known northern goshawk territories (see Map 2-3). The occurrence of flammulated owl, white-headed woodpecker, and American marten in the landscape analysis area is unknown. Information on species occurrence and distribution of the selected focal species is limited. Based on the best available information on species-habitat relationships and local knowledge of forest conditions, preferred suitable habitat features (e.g., tree species composition, large trees with multi-strata or single-stratum structure, moderate to dense canopy closure, and deadwood component) for the focal species grouping or wildlife assemblage are known to occur in the Clear Creek/Kings Canyon landscape analysis area, especially in the upper elevations of Clear Creek watershed.

A detailed stratification or mapping of forest types, structural stages, and canopy closure; and a comprehensive inventory of old forest habitat and snags and downed wood and logs are needed to identify potential suitable habitats for the focal species at the landscape scale.

Modification of the existing vegetation structure should be considered as a possible management practice within the Clear Creek watershed. The treatments (including mechanical thinning and/or

prescribed fire) would enhance the habitat capability of the existing tree-dominated old forest and reduce the potential loss or degradation of habitats in the Old Forest Emphasis Areas. In general, thinning and partial cuttings could be used to meet treatment objectives for tree growth redistribution, tree species regulation, timber harvest, wildlife habitat improvement, and wildfire-hazard reduction (Graham and others 1999). Stand structure improvement treatments for the old forest habitat should be integrated with the fuel hazard reduction strategy for wildfire risk mitigation. Succession and stand dynamics have led to increased vulnerability of the montane conifer forests to wildland fires and insects and diseases, putting old forest habitat persistence at risk. Landscape pattern (or patch characteristics) should be a management consideration for the maintenance and/or enhancement of forest conditions. Riparian areas could be used as wildlife movement corridors in the Clear Creek/Kings Canyon landscape analysis area.

### **Potential Management Impacts**

Vegetation and fuels treatments (including strategically placed treatments and wildland fire use) for wildfire risk/hazard mitigation will be implemented on National Forest System lands in the Clear Creek/Kings Canyon landscape analysis area. Species associated with old forest and riparian habitats may be vulnerable, if uncontrolled modification of forest structure (e.g., tree size distribution, canopy cover, snags, and downed woody material) and landscape habitat connectivity (e.g., riparian areas and landscape mosaic) were implemented. However, the land allocation standards and guidelines provided in the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a) should be used as management prescriptions to meet the land and resource management objectives. Limited operating periods should be applied at PACs and den sites of focal species during nesting and denning seasons to protect breeding adults and their offspring from potential impacts from roads (including road maintenance) and trails uses, OHV routes, existing recreation facilities, and proposed recreation improvements related disturbances.

#### **6.1.4 Forest Insects and Diseases**

Currently, forest insects and diseases are at endemic levels within the Clear Creek/Kings Canyon landscape analysis area. Past insect-caused tree mortalities at larger scales within the landscape analysis area involved Jeffrey pine beetle, fir engraver in true fir, and mountain pine beetle in lodgepole pine under drought conditions. Dense stocking in existing forested vegetation and homogenous stand ages increases the vulnerability of the area's forests to insect outbreak when trees are stressed.

Currently, weather records show a pattern of lower than average precipitation for the past four years (see Appendix F). Forested elevations (weather data represented by Dagget Pass station) have received less than half of the average annual precipitation for three of the past four years. Under drought conditions, forested vegetation within the landscape analysis area may be susceptible to insect-caused tree mortalities, particularly where existing stand density remains high and insect-susceptible tree species dominate. The insect-caused tree mortalities and subsequent salvage logging that occurred in the mid-1990s have decreased stand densities within some parts of the landscape analysis area; however, stand densities remain high for many existing forested areas and continue to be vulnerable to insect-caused tree mortalities. Fuel treatments using thinning and similar treatments would reduce stand densities and maintain or increase tree vigor. The fuel-reduction treatments would be expected to improve resistance to insect- and disease-caused tree mortalities (USDA Forest Service 2002b).



### **6.1.5 Noxious Weeds**

In 1992, the state of Nevada officially designated 29 species as noxious weeds. Within 10 years, in 2002, the species list included 17 additional noxious weeds. The majority of areas infected by noxious weeds in Nevada currently include pastures, rangelands, sagebrush lands, and riparian areas (State of Nevada 2003).

The limited inventory of noxious weeds on the National Forest System lands within the Clear Creek/Kings Canyon landscape analysis area suggests additional surveys may find unknown populations of noxious weeds. High-risk areas for noxious weed infestations in the analysis area include recreation development sites, road cuts, rangelands, pastures, and riparian areas. The CDFA ratings, as used in the Sierra Nevada Forest Plan Amendment, rank noxious weed species for treatment priority. “A” has the highest priority and “C” has the lowest. Musk thistle and Scotch thistle are rated as “A”; whitetop/hoary cress is rated as “B”; and yellow starthistle, medusahead rye, and St. Johnswort are rated as “C” (see Table 4-2). The effectiveness of noxious weeds and undesirable plants treatments on National Forest System lands should be monitored.

## **6.2 Social and Cultural Conditions**

### **6.2.1 Recreation Opportunities Management**

Current recreation opportunities in the Clear Creek/Kings Canyon landscape analysis area vary, including Semi-Primitive Non-Motorized ROS, Semi-Primitive Motorized ROS, and Roaded Natural ROS (see Appendix D for definitions of ROS). A gap exists between the current National Forest System lands recreation opportunities and the demand for recreation activities. This conclusion comes from USFS information on existing recreation facilities in the landscape analysis area, the recreation use patterns, and the expected population growth in Carson City and Douglas County. The population surrounding the Carson Ranger District and other outside-the-area visitors demand access to more recreation opportunities. Additional looping trails and developed recreation facilities, such as day use facilities and trailheads, are needed to meet the existing demand.

The desired condition for recreation in the landscape analysis area is to meet expected demand for developed recreation, in partnership with Carson City and Douglas County. For Carson City and Douglas County, the recreation management will be consistent with Carson City Open Space Plan (Winston Associates and others 1999) and Douglas County Open Space and Agricultural Lands Preservation Plan (Douglas County 2000), respectively.

Suitable recreation opportunities for each area within the Clear Creek/Kings Canyon landscape analysis area vary depending on the existing recreation uses, USFS-mapped land allocations, and existing natural resource conditions. The Clear Creek, Kings Canyon, and Voltaire Canyon areas have high demands for recreation use. These areas have soils that are sensitive to ground disturbances and subsequent noxious weed infestations. Increased recreation use in these areas could impact natural resources by disturbing soils, resulting in accelerated erosion and sedimentation. Therefore, future motorized and non-motorized recreation opportunities should use designated travel routes. Additionally, environmentally sensitive areas such as RCAs and PACs should be given consideration when future trails or recreation facilities are located and when the acceptable types and levels of recreation use are determined.

A vast portion of the Clear Creek/Kings Canyon landscape analysis area is rated as high and moderately high fire hazard (see Map 6-1). Development of a day use facility for more intensive recreational use could decrease the risk (probability of ignition) of human-caused wildfires in higher hazard areas by concentrating human activities in a smaller area. There are opportunities in the Kings Canyon area, along Kings Canyon Road, to develop a day use recreational facility adjacent to Carson City-owned lands.

### **6.2.2 Scenery/Visual Quality**

The 1986 Toiyabe National Forest Plan established VQOs for the Clear Creek/Kings Canyon landscape analysis area. The objectives include Modification, Partial Retention, and Retention (see Appendix E for definitions of VQOs). Scenic or visual quality is a key resource for the HTNF, Carson City, and Douglas County. Both Carson City and Douglas County cite visual integrity (in the 1999 Carson City Open Space Plan and 2000 Douglas County Open Space and Agricultural Lands Preservation Plan, respectively) as a major criterion when identifying prime open space. Desired future conditions and management directions, as adopted in the 1986 Toiyabe National Forest Plan, specify that the Retention VQO should be met along U.S. Highway 50. The Retention VQO along U.S. Highway 50 is not represented in the adopted VQO for the Clear Creek/Kings Canyon landscape analysis area (see Map 4-5). Also, the USFS has not assigned VQOs for numerous areas on National Forest System lands (see Map 4-5).

In addition to U.S. Highway 50, the other important travel routes and use areas in the Clear Creek/Kings Canyon landscape analysis area include Spooner Summit day use area near the Tahoe Rim Trail and National Forest System lands adjacent to urbanized Carson City. The adopted VQOs adjacent to the urbanized Carson City are Modified and Partial Retention. Some areas of National Forest System lands adjacent to Carson City have not been assigned VQOs. When the USFS does assign a VQO, it should consider these important travel routes and recreation use areas and apply a VQO that retains much of the natural landscape characteristics for scenic integrity.

### **6.2.3 Roads and Trails Access**

A network of system and non-system roads and trails are present throughout the Clear Creek/Kings Canyon landscape analysis area. Most of the trails and roads currently used by recreationists are not a part of the Forest Service trail system. Pressure from visitors and residents of Carson City for increased recreation opportunities and developed recreation facilities is evident and expected to increase as the population grows. Recreation facilities on National Forest System lands may be linked with recreation facilities on Carson City and Douglas County lands by designating existing routes as trails, creating trailheads and parking areas, and building new trails.

Currently, hikers, mountain bikers, and equestrians are creating a loop from Kings Canyon to Clear Creek through the landscape analysis area by crossing U.S. Highway 50 just east of Spooner Summit day use area. This practice is a serious safety hazard for all recreationists crossing the road and for the motorists on the U.S. Highway 50 segment within the landscape analysis area. There is an urgent need to develop a reasonable solution for recreation users in this area to complete this loop between Kings Canyon and Clear Creek.

A desired condition for OHV use on National Forest System lands includes compatibility with other resource programs. Indiscriminate OHV use should be avoided to reduce degradation of natural and

cultural resources. To help monitor or direct OHV use to compatible areas, the Toiyabe National Forest Plan (1986) states that closures or restrictions should occur if there are obvious conflicts with other uses and if resource damage might result. Some OHV use in the Clear Creek/Kings Canyon landscape analysis area is indiscriminate and degrades resource integrity.

The Carson Ranger District has constructed boulder blockades on pioneered OHV paths forged on National Forest System lands. Carson Ranger District staff monitor the heavily used areas bimonthly. Increased residential development is projected for lands adjacent to the Clear Creek/Kings Canyon landscape analysis area. With the population growth, public OHV use on National Forest System lands is expected to increase. The existing USFS Travel Management Map was last updated in 1994 and shows only a few roads in the Clear Creek/Kings Canyon landscape analysis area, which makes it difficult for current users to know the restricted uses for each trail or road. Signs indicating the allowed use are only posted for some roads in Voltaire Canyon.

Designated motorized and non-motorized trails and loops are needed within the Clear Creek/Kings Canyon landscape analysis area. Soils in Clear Creek, Kings Canyon, and Voltaire Canyon are sensitive to disturbance, so using existing paths, when available, would minimize the recreation-related potential impacts on natural and cultural resources.

#### **6.2.4 Heritage Resources and Tribal Use**

Approximately 2,700 acres in the Clear Creek/Kings Canyon landscape analysis area have been extensively surveyed for heritage resources, and 58 historic archaeological sites have been recorded. The heritage resources in the surveyed area consist primarily of historic sites related to a variety of human land and resource uses since the 1850s. The low density of prehistoric sites may be because of historic land use practices. To date, the most important archaeological resources identified in the landscape analysis area are located in the Spooner Summit vicinity. This area includes archaeological sites associated with the Comstock era and post-Comstock era, including historic roads, logging flumes, recreation sites, domestic animal grazing areas, artifacts, and historic or cultural features. Of the 58 formally recorded archaeological sites in the Clear Creek/Kings Canyon landscape analysis area, only a few have been evaluated for the NRHP. These sites include portions of the Clear Creek Flume/Spooner Summit Complex and Kings Canyon Road, and the Swift's Station. The Rufus Walton Toll Road is an important site that requires further research and evaluation. The assemblage of heritage resources in the landscape analysis area exhibits attributes that make it suitable as a National Register historic district.

Potential threats to heritage resources in the Clear Creek/Kings Canyon landscape analysis area consist of natural environmental processes (e.g., natural erosion and wildfire) and human activity (e.g., recreation OHV use and prescribed burning). For instance, erosion and vehicle traffic have been identified as elements endangering the integrity and attributes of sites such as the rock features along Kings Canyon Road, and OHV use has impacted portions of Swift's Station remains. Wildland fires, prescribed burning, and wildlife suppression activities pose potential threats to ground surface heritage resources (Hanes 2001; Communicator's Guide 2003).

The National Historic Preservation Act of 1966 ensures the protection and enhancement of historic properties on National Forest System lands. The Clear Creek/Kings Canyon landscape analysis area contains previously identified and significant historic properties eligible for inclusion on the NRHP.

The high levels of current recreational use and the demands for fire and vegetation management within the analysis area point to a need for a comprehensive and detailed cultural resource management plan. Such a plan would contain provisions for the protection of significant cultural values during other land management activities and provide opportunities to integrate the rich historic legacy with recreational use of the area through interpretation.

Although only one prehistoric site has been identified and formally recorded in the Clear Creek/Kings Canyon landscape analysis area, the Washoe people have strong traditional ties to the area and are interested in management activities on National Forest System lands and protection of natural and cultural resources. Tribal members actively use the area for traditional cultural purposes. Land management planning, decision-making, and implementation should continue to incorporate consultation with the Washoe Tribe at the government-to-government level.

### **6.2.5 Law Enforcement**

One of the goals of law enforcement stated in the Toiyabe National Forest Plan is that the public should be educated in proper use of the National Forest. Protection of the resources and recreational uses, provided through improved law enforcement, is a desired condition under the Forest Plan (USDA Forest Service 1986). Late-night parties, trash dumping, illegal campfires, and OHV use in unauthorized areas within National Forest System lands in the Clear Creek/Kings Canyon landscape analysis area are not consistent with desired conditions under the Forest Plan. An intergovernmental agreement exists between the HTNF (Carson Ranger District) and the Douglas County Sheriff's Department. Future law enforcement actions should address the human uses in the Clear Creek/Kings Canyon landscape analysis area that are impediments to accomplishing the desired conditions under the Forest Plan. The law enforcement initiatives should include officials from the HTNF (Carson Ranger District) and law enforcement personnel from Carson City and Douglas County.

## **6.3 Watershed Conditions and Roads**

### **6.3.1 Erosion Processes and Sediment Dynamics**

Current conditions for watershed and roads were described in Chapter 4. In general, several factors influence soil erosion and sediment delivery to streams; the most important parameters for the area are soil cover, soil detachability, and slope (Costick 1996). Vegetative cover varies throughout the Clear Creek/Kings Canyon landscape analysis area, but it is generally sufficient protection against surface erosion. However, in areas where the protective vegetative cover has been disturbed (e.g., by wildfire, road construction, and historical logging), the potential for erosion and sediment delivery to streams has increased (PBS&J 2003).

In general, soil detachability in the Clear Creek/Kings Canyon landscape analysis area is high. The loose sandy soils have relatively low soil cohesion, resulting in greater vulnerability to soil particle transport. However, these coarse soils allow for rapid infiltration of precipitation so that most water travels through these watersheds as subsurface flow instead of surface runoff. Runoff occurs most commonly following extreme meteorological events (storms and rain-on-snow) and in saturated deeper soils on concave slopes and drainages. Under these circumstances, sandy soil particles are occasionally suspended in surface runoff. Because these particles are relatively heavy, they generally settle out quickly. Very steep slopes (greater than 40 percent) throughout the analysis area are also susceptible to periodic mass wasting (including slumps, slides, and soil creep), particularly in areas

with deeper, moister soils. Erosion from these very steep areas is part of the natural geologic erosion regime of this mountainous area (USDA Forest Service 1993a).

Anthropogenic changes during the last 50 years have likely increased the magnitude and frequency of erosion and sedimentation in the Clear Creek/Kings Canyon landscape analysis area (PBS&J 2003). Localized mass erosion has occurred on some hillslopes, and concentrated runoff from roads has resulted in visible gullying and soil erosion. Roads (including U.S. Highway 50) and associated gullies were documented as the most significant sediment sources in the forested area of Clear Creek (USDA Forest Service 1993a). Watershed resources are identified as a key value in the Carson Front area. Erosion and sedimentation rates that exceed the natural background levels in which aquatic and riparian species evolved are inconsistent with desired conditions, as described in the Sierra Nevada Forest Plan Amendment and the Toiyabe National Forest Plan. The goals stated in these documents include restoring and enhancing water quality, and enhancing soil and water conditions.

The general description of erosion and sedimentation in the landscape analysis area is supported by a study of the forested area in the upper portion of Clear Creek. In that area, sheet and rill erosion (because of natural and anthropogenic soil disturbance) make up just over 10 percent of the total sediment sources (USDA Forest Service 1993a). Very steep slopes (greater than 40 percent) also contribute to sedimentation through mass failures near road cuts and steep areas (USDA Forest Service 1993a). Anthropogenic disturbances (e.g., roads, development, and grazing) to vegetative cover and drainage account for the remaining sediment budget, with most sediment attributed to roads and a much smaller portion to bank erosion enhanced by grazing.

Additional monitoring and evaluation of erosion and sedimentation in the Clear Creek/Kings Canyon landscape analysis area would allow for better management of watershed resources. Monitoring of watershed resources is listed as a goal in the Toiyabe National Forest Plan because it provides information for quicker response to management-induced impacts on soil and water resources. Knowledge from monitoring, evaluation, and research can be used for adaptive management of watershed resources and on-the-ground project implementation.

### **6.3.2 Runoff and Water Quality**

In general, surface runoff rates are relatively low in the Clear Creek/Kings Canyon landscape analysis area (USDA Forest Service 1993a). Because infiltration and percolation rates are high in the sandy soils of this area, rainfall infiltrates and moves as subsurface flow instead of surface runoff. Runoff in the Clear Creek/Kings Canyon landscape analysis area is most affected by convective summer thunderstorms and rain-on-snow events. The most recent 1997 flood followed a rain-on-snow event, during which rainfall saturated the existing snowpack and caused rapid melting.

Water diversions on Kings Canyon Creek and Clear Creek (USDI Geological Survey 2003) likely reduce peak flows and result in more frequent low flows, including periods of no flow during dry seasons. Other anthropogenic activities (e.g., roads and development) have modified runoff in the Clear Creek/Kings Canyon landscape analysis area (PBS&J 2003). According to a 2003 erosion assessment (PBS&J 2003), changes in vegetation cover and constructing impervious surfaces like roads have affected the timing and amount of runoff. Road construction has also concentrated flows into culverts and other drainage facilities and moved water to areas that historically did not convey substantial runoff (PBS&J 2003). Depending on their magnitude, these changes to the existing

hydrologic regime of the Clear Creek/Kings Canyon landscape analysis area may be inconsistent with the desired conditions. The Sierra Nevada Forest Plan Amendment and the Toiyabe National Forest Plan identify watershed resources as a key value and emphasize the importance of maintaining and restoring in-stream flows sufficient to sustain aquatic species.

Water quality impairment, according to the Clean Water Act, has been documented in only one stream segment in the Clear Creek/Kings Canyon landscape analysis area. The segment of Clear Creek from the headwaters to the USGS gaging station is included in Nevada's 303(d) list for water quality impairment (because of elevated pH) (EPA 2003). Accelerated sedimentation in Clear Creek was documented in the Clear Creek erosion assessment (PBS&J 2003). The Sierra Nevada Forest Plan Amendment specifies that water quality be maintained and restored to meet goals of the Clean Water Act (1972, as amended) and Safe Drinking Water Act (1974, as amended).

### **6.3.3 Erosion and Sedimentation Vulnerability**

As described in Chapter 4, the Clear Creek area has the highest relative vulnerability to erosion of the landscape analysis area, based on the extent of slopes with gradients greater than 40 percent and slope positions (lower 40 percent) near streams. These areas represent the greatest potential for erosion (high slope gradients) and sedimentation (low slope positions). In addition to inherent landform characteristics, the extent of disturbances, particularly anthropogenic disturbances, also affects the erosion and sedimentation vulnerability throughout the landscape analysis area.

Roads produce notable impacts to erosion and sedimentation in the Clear Creek/Kings Canyon landscape analysis area (PBS&J 2003). The landscape analysis area includes approximately 60 miles of existing roads and another 10 miles of unimproved four-wheel drive trails. At least eight additional miles of non-motorized trails also exist throughout the landscape analysis area. The Clear Creek area experiences chronic sediment inputs from U.S. Highway 50 (PBS&J 2003). According to HTNF GIS data, National Forest System lands have moderate road densities, particularly compared to private, tribal, and Nevada state lands. Incomplete GIS coverage for roads on National Forest System lands may result in an under-representation of roads on these lands. Across land ownership, combined roads and trails density is highest in Voltaire Canyon, at approximately 3.9 miles per square mile. The moderately high density of roads in the Clear Creek/Kings Canyon landscape analysis area may conflict with the desired conditions specified in the Sierra Forest Plan Amendment. Soils with favorable infiltration characteristics and diverse vegetative cover should be maintained and restored to absorb and filter precipitation. Interruption of natural drainage patterns and soil disturbance caused by roads throughout the existing relatively sensitive areas should be avoided.

Several roads throughout the entire Clear Creek/Kings Canyon landscape analysis area traverse areas identified as higher relative vulnerability to erosion, based on high slope gradient (greater than 40 percent) and location near streams (lower 40 percent in slope position). In addition, approximately 20 miles of roads and trails in the Clear Creek/Kings Canyon landscape analysis area fall within RCAs, resulting in an average density greater than 50 miles per square miles of RCAs (see Map 2-3 for RCA land allocation). Roads and trails near streams can disrupt these sensitive areas, causing increased sedimentation to streams.

Road-stream crossings also often deliver excessive sediment to stream channels. Culverts can be easily damaged or plugged, which results in poor drainage and eventually sufficient water capacity to blow out the culvert and all of the nearby materials, introducing pulses of sediment directly into streams. According to HTNF GIS data, there are 33 road-stream intersections on National Forest System lands and 29 intersections on private lands. Abundant road-stream crossings can degrade desired conditions of watershed resources.

Roads also increase landslides or instability hazard by increasing slope gradients, expanding the saturated zone, altering material strength properties, and decreasing stabilizing root mass (Megahan and Kidd 1972). Debris slides are more common on roads than undisturbed forested areas. Roads can trigger landslides following large precipitation events. The Clear Creek and Voltaire Canyon areas have relatively high road densities, particularly in areas susceptible to erosion (high slopes near streams).

### **6.3.4 Transportation System and Access**

According to the Toiyabe National Forest Plan, the desired transportation system in the Clear Creek/Kings Canyon landscape analysis area would provide user safety, convenience, and efficiency to accomplish land and resource management objectives. The main arterial and collector roads in the area are Kings Canyon Road and Voltaire Canyon Road (USDA Forest Service 2003c). According to the Travel Management Map, most of Kings Canyon Road is not suitable for passenger cars (USDA Forest Service 1994c). The Kings Canyon Road is no longer passable to vehicles because of washouts on private lands and disturbance to the roadbed. Several sections of Clear Creek Road above the gate have washed out. Under desired conditions, traffic would be restricted on roads not constructed to an all-weather standard. Construction and reconstruction would support resource activities, such as fire suppression and vegetation treatment. Maintenance levels for local roads would be documented in the USFS Transportation Facility Operation and Maintenance Schedule.

The existing road system likely meets some of the desired conditions and falls short of others. Information regarding the current use and maintenance levels of the existing roads in the Clear Creek/Kings Canyon landscape analysis area is generally lacking. Such information could be collected and used to prepare the annual Travel Management Map for the Carson Ranger District. According to the Toiyabe National Forest Plan, the travel map should be developed every year. Because of insufficient funding and staff availability, more frequent updates of the travel map have not been possible since 1994 (USDA Forest Service 1994c). However, such an effort would be beneficial in describing current road use and maintenance. Similarly, the HTNF conducted a forest-wide roads analysis, in response to the USFS road management policy that requires a roads analysis prior to road construction, reconstruction, or decommissioning (USDA Forest Service 2003c). Within the landscape analysis area, the road management objectives (RMOs) for Kings Canyon Road and Voltaire Canyon Road were included in the roads analysis (USDA Forest Service 2003c) (see Appendices H-1 and H-2 for RMOs).

In addition to the access issues related to recreation (presented in Section 6.2), road accessibility should also be maintained for administrative use, including fire protection and suppression, vegetation/fuels treatments, and safety. Opportunities may exist to develop historical roads as interpretive trails. Absent a landscape/watershed-specific roads analysis, the existing road pattern and density are likely sufficient to provide access for these uses.

Expanding road networks have created many opportunities for new uses and activities on National Forest System lands, but they have also dramatically altered the landscape pattern (USDA Forest Service 2001b). An appropriate balance between the benefits of access to the National Forest System lands and the costs of road-related impacts to watershed, wildlife, and visual resources should be achieved. Providing road systems that are safe to the public, responsive to public access needs, environmentally sound, affordable, and efficient to manage are stated among the USFS's top priorities (USDA Forest Service 2001c).

## **6.4 Management Situation and Considerations**

In the current forested landscape, advanced forest succession and associated accumulation of forest biomass have led to increased vulnerability to wildland fires, insect- and disease-related disturbances in the montane conifer forests. The increased risk of wildland fires threatens property and other ecosystem values, including native plant communities (by introduction of exotic, undesirable plant species), wildlife and fish habitats, soils and water resources, recreation opportunities, and heritage resources. Large wildfires can create a homogenous landscape pattern (by changes in patch dynamics or landscape mosaic) that potentially affect scenery/visual quality and also result in forest habitat fragmentation with loss of habitat connectivity.

Based on the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a), landscape-level fire and fuels management strategies (including mechanical treatments, prescribed fire, and lightning-caused wildland fire) would be used in the Clear Creek/Kings Canyon landscape analysis area to modify the existing fire pattern and improve fire-dependent ecosystems. Strategically placed area treatments (SPLATs) would be used as a fuel hazard reduction strategy outside the urban wildland intermix fire defense zone within the landscape analysis area. Other vegetation and fuel treatments would be conducted within the urban wildland intermix fire defense zone for hazardous fuel reduction.

While vegetation and fuels treatments may be successful in mitigating potential wildfire risk, considerations should be given to other resources before implementation of the treatments. Similarly, prescribed fire may be beneficial for restoring fire-dependent ecosystems (particularly for aspen in riparian areas), but other resources should also be considered. The vegetation and fuels treatments could potentially impact soils and water, wildlife habitat (old forest and aquatic/riparian), visual quality, cultural resources, and recreation opportunities.

Best management practices, with monitoring and evaluation components as part of adaptive resource management, would aid in ensuring that the natural and cultural resources were adequately considered. The applications of the standard and guidelines for all the land allocations outlined in the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001a) and other relevant best practices would minimize potential ecological impacts in the Clear Creek/Kings Canyon landscape analysis area.

For mechanical treatment, various best management practices have been effective at mitigating the extent of detrimental disturbance, including slope limitations for ground-based equipment, designated skid trails, and timing of activities (outside wet weather period). Soil quality standards pertaining to ground cover, compaction, and ground disturbance should be implemented to minimize the risk of sediment delivery to the aquatic system from management activities. Prescribed



fires may increase the potential for surface runoff and erosion (Emmerich and Cox 1992; Emmerich and Cox 1994). Proper management strategies can improve physical and hydrologic soil characteristics by creating mosaic patterns of areas with contrasting hydrological properties (Fitzjohn and others 1998). Vegetation mosaics of varying vegetation types and structural attributes, created with prescribed burning, may prove effective at reducing runoff and soil erosion.

Prior to implementing vegetation and fuel treatments, potential changes to visual quality should be considered, particularly for treatments proposed along the U.S. Highway 50 segment within the Clear Creek/Kings Canyon landscape analysis area. In addition, potential adverse disturbances to cultural sites should be considered. Cultural surveys and best management practices should be used to minimize the potential impacts.

Fuel hazard reduction treatments may rely on the existing transportation system in the Clear Creek/Kings Canyon landscape analysis area. Before any improvements to the road network are planned, the potential impacts to other resources should be carefully considered. The same logic applies to any expansion to existing recreation facilities. Forest roads may contribute to watershed erosion and sedimentation, and species-habitat fragmentation. Careful consideration of which roads are necessary to meet recreational uses, fire protection and suppression access, vegetation and fuels treatments, law enforcement and safety, and other administrative uses should be given during the planning stages of any road-related projects, such as conversion of existing roads to trails and road decommissioning. Closing existing roads to public access while maintaining access for administrative use may limit damage to land and resources from OHV use and other recreational activities. Maintenance schedules should also consider potential road reconstruction to ensure adequate conditions for passage of fire suppression equipment. Areas near existing and proposed developments should be prioritized for road accessibility (road condition and speed of ingress or egress) and maintenance.

The potential for noxious weed infestations should be considered in developing any additional areas for OHV use. Areas that experience increases in use and disturbed sites may be susceptible to noxious weed infestations. A survey of the area, proposed treatments, and follow-up monitoring for noxious weed populations would be helpful in controlling the potential impacts of recreational uses on native plant communities.

Smoke from prescribed burns could affect air quality in the Carson City area and it should be a consideration when planning the burns. Burning under favorable smoke dispersal conditions and away from sensitive areas may mitigate smoke. Burns should be avoided on high visitor days.

Recreational use (including mountain biking, OHV use, snowmobiling, hiking, picnicking, camping, cross-country skiing, hunting, and fishing) for the Clear Creek/Kings Canyon landscape analysis area is relatively high as a result of its proximity to population centers such as Lake Tahoe, Carson City, and Reno. Increased local development along the Carson Front Range also increases the demand for recreational use and public access of the National Forest System lands. Recreational developments, including day use areas and motorized and non-motorized trails, and other facilities are identified for the analysis area.

Regardless of the USFS's land and resource management activities in the Clear Creek/Kings Canyon landscape analysis area, human settlement and development will likely continue throughout this area.

Expansion of the populated areas and changes in land use within the analysis area may affect the existing resources. The extent of the urban wildland intermix zone would increase, which warrants additional emphasis on fuel hazard reduction treatments. Recreational uses may change along with changing land uses within the analysis area. Additional infrastructure, such as roads and power transmission lines, may be necessary. These structures have the potential to degrade soil and water resources, disturb cultural sites, and fragment wildlife habitats. Noxious weeds likely spread more rapidly through the analysis area with increased vehicular traffic. To the extent possible, these issues and concerns should be addressed through cooperation with other landowners in the landscape analysis area and through active management of National Forest System lands.

Insert Map 6-1

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## CHAPTER 7. RECOMMENDATIONS

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The purpose of Chapter 7 (EAWS Step 6) is to present a set of management recommendations that respond to the issues and key questions identified in Chapter 3, that are based on the synthesis and interpretations in Chapter 6. The recommendations should also be responsive to landscape/watershed processes identified in the analysis for moving the landscape toward desired conditions. Management opportunities and recommendations, rationale for proposed actions, data/information gaps and needs, and adaptive management are discussed below.

### 7.1 Vegetation and Fuels

#### 7.1.1 Urban Wildland Intermix Defense Zone

- Treat fuels in the eastern edge of Section 5 (T14N, R19E), adjacent to the proposed golf course development (the Schneider Ranch property) (Map 7-1). Fuels treatment options in this high hazard area should consider the design of the proposed development. Forest Service should seek potential opportunities to work with the developers to design more fire safe conditions and reduce wildfire hazard/risk within and adjacent to the development area.
- Treat fuels in the area just south of U.S. Highway 50 in the southeast corner of Section 33 (T15N, R19E), directly west of the Nevada State Youth Camp (Map 7-1). The construction of an underpass associated with the Schneider Ranch property development is tentatively proposed just east of this area. The adjacent highway and potential construction of the underpass would effectively widen the potential area treated for hazardous fuels reduction.
- Reduce hazardous fuels using mechanical treatment in pockets of dense sagebrush in the northeast portion of section 23 (T15N, R19E) in the Kings Canyon area (Map 7-1). The vegetation treatment would provide a fuelbreak near existing homes adjacent to this area. The current Forest Service mapped land allocation for this area is General Forest.
- Cooperate with Clear Creek private landowners in the implementation of vegetation/fuel treatments within the urban wildland intermix defense zone. The Clear Creek private landowners' *Wildfire Risk/Hazard Assessment and Risk Mitigation Plan* prepared by Dynamac Corporation (August 2003) proposed the following mitigation actions for the Clear Creek assessment area, in order of priority (see Appendix I for a map of proposed mitigation actions):
  1. Establish firebreak/shaded fuel break at the western end of Clear Creek assessment area;
  2. Fuel reduction on south side of Highway 50 right-of way;
  3. Reduce fuels around existing homes;
  4. Establish firebreak between Sections 34 and 35;
  5. Develop water storage facilities; and
  6. Establish shaded fuel break south of Clear Creek in T14N, R19E, Section 2.
- Design fuel treatments cooperatively with the Nevada Division of Forestry, Carson City Fire Department, East Fork Fire District, and Douglas County for the Clear Creek watershed.

Fire and fuels management are complex for this area as a result of the existing urban wildland interface communities.

### **7.1.2 Urban Wildland Intermix Threat Zone and Others**

- Apply strategically placed area treatments (SPLATs) to effectively modify the wildland fire behavior and interrupt fire spread across the landscape (Map 7-1). Treatment blocks are placed so that a spreading fire will be slowed and of lesser intensity as it approaches the fire defense zone.

Mechanical thinning and prescribed fire should be considered for vegetation/fuels treatments in the SPLATs. Vegetation/fuels treatments should be consistent with the standards and guidelines outlined in the Sierra Nevada Forest Amendment (USDA Forest Service 2001a). Field verification of vegetation mapping (e.g., vegetation types and structure attributes), fuels classification (e.g., fuel density and moisture), and wind direction are necessary to improve the on-the-ground layout of the SPLATs. The SPLATs locations include roaded and inaccessible areas. Determination of yarding methods (e.g., ground, cable, or helicopter based systems) for mechanical thinning would be dependent in part on local topography and elevation, existing roads and landings, public safety, and economic feasibility. The layout of the SPLATs should be modified, as required, based on on-the-ground information.

- Use prescribed fires as follow-up fuel reduction treatments after stand structure modification by mechanical methods in the SPLATs. Smoke management and air quality protection are important considerations for prescribed fires. When burning opportunities are limited because of concerns that the smoke may affect air quality, mechanical treatments such as mastication and piling should be used. Field evaluation of existing forest conditions is important prior to the use of prescribed fires to reduce surface fuels.
- Use mechanical treatments and prescribed fires to maintain the existing fuelbreak in the southwest portion of the Clear Creek area (Map 7-1).
- Use mechanical thinning and/or prescribed fire for fuel reduction treatments in Old Forest Emphasis Areas and Riparian Conservation Areas (Maps 2-3 and 7-1) within the proposed SPLATs. Fuel treatments in these areas may be necessary to reduce wildfire hazard and improve existing forest condition (i.e., species composition and structure). Prescribed fires in RCAs should be considered to restore selected fire-adapted riparian vegetation, including aspen.
- Consider the use of grazing animals (i.e., sheep) to reduce fuels in cheatgrass-dominated areas.

### **7.1.3 Noxious Weeds and Undesirable Plants**

- Survey and map the occurrence and distribution of noxious weeds and undesirable plants. Focus the field surveys in the following areas: areas burned recently, travel corridors, recreation facilities (e.g., campgrounds, day use areas, and OHV trails), and other disturbed areas, especially in rangelands and shrublands.

- Manage the known occurrences of noxious weeds using an integrated weed management approach. Work with local weed management groups to ensure that noxious weeds are effectively being managed. Newly located noxious weed populations on National Forest System lands in Kings Canyon should be treated. Noxious weed populations known to occur (e.g., musk thistle, Scotch thistle, whitetop/hoary cress, yellow starthistle, medusahead rye, and St. Johnswort) on National Forest System lands in the Clear Creek/Kings Canyon analysis area should continue to be treated and monitored. Undesirable plants known to occur (e.g., chicory, bull thistle, curly dock, and morning-glory) on National Forest System lands should continue to be treated and monitored. The noxious weed management strategy should implement best management practices, as appropriate, to meet the land allocation standards and guidelines in the Sierra Nevada Forest Plan Amendment.

## **7.2 Recreation**

### **7.2.1 Day Use Area**

- Create a day use area in Kings Canyon. The proposed Borda Meadows day use area (locally referred to as Griffith Grove), which would be accessed from a spur road off of Kings Canyon Road, should be developed in partnership with Carson City (Map 7-2).

### **7.2.2 Trailheads**

- Lower Kings Canyon Trailhead: This trailhead would be located on National Forest System lands off of Carlisle Court (near Kings Canyon Road) (Map 7-2). It would connect a National Forest System non-motorized trail with Carson City streets and trails through an existing public access easement.
- Borda Meadows Trailhead: In partnership with Carson City, improve the trailhead parking area and expand the information center located on National Forest System lands (Map 7-2) near the waterfall.
- Upper Kings Canyon Trailhead: Create a trailhead, parking area, and information center (Map 7-2). Opportunities exist to access the scenic vista point to the southeast and connect to the Borda Meadows Day Use Area to the east via a trail.
- Voltaire Canyon Trailhead: In partnership with Carson City, create an OHV staging area with an information center in Voltaire Canyon near the Carson City watertank (Map 7-2). This facility will provide information on designated four-wheeled drive routes and guide OHV use in the area.
- Fuji Park: Establish an information center in Fuji Park in cooperation with Carson City to educate the public about the recreation opportunities in the area (Map 7-2).
- Clear Creek Trailhead: Improve the trailhead parking area along the Old Clear Creek Road, west of the Nevada State Youth Camp (Map 7-2). An opportunity exists to work with Douglas County and the Schnieder Ranch developers to improve the existing trailhead facilities or create new facilities on private property.

- Spooner Summit Day Use: Improve the existing Spooner Summit day use area and trailhead for year-round uses (Map 7-2). Explore ways for visitors using the Tahoe Rim Trail, Clear Creek Road, and Kings Canyon Road to safely cross U.S. Highway 50.

### **7.2.3 Non-Motorized Trails**

- Kings Canyon Area: In partnership with Carson City, create a trail from the Upper Kings Canton Trailhead to Borda Meadows Day Use area. Connect the Borda Meadows Day Use area to the Borda Meadows Trailhead and the Lower Kings Canyon Trailhead via new trail construction and conversion of existing two-track roads (Map 7-2).
- Capital to Capital Trail: In partnership with Carson City, explore the possibility of connecting Kings Canyon Road or other trails in the area with the Tahoe Rim Trail. This connection would facilitate the plan for a regional trail system from Sacramento, California to Carson City, Nevada.
- C Hill: In partnership with Carson City, connect C Hill with the trail system in Kings Canyon (Map 7-2). This would provide an additional connector to the trail system on National Forest System lands.
- Clear Creek Area: Retain the Old Clear Creek Road as a travel route for non-motorized use. Work with private landowners for developing a connector trail to link the Old Clear Creek Road to Spooner Summit Day Use area (Map 7-2).

### **7.2.4 Motorized Roads and Trails**

- Voltaire Canyon and Kings Canyon: In partnership with Carson City, designate a system of OHV use roads and trails. The road network would utilize existing roads and may involve the relocation of some road segments and new road construction. Using existing roads and trails identify a travel route from the Voltaire Canyon OHV trailhead to Kings Canyon.
- Kings Canyon Road: The Kings Canyon Road to Spooner Summit should allow access for public recreation use and be maintained for high clearance vehicle.
- Old Clear Creek Road: Maintain the Old Clear Creek Road from the Clear Creek Trailhead on National Forest System lands to Spooner Summit for fire-related access and administrative use.

## **7.3 Scenery Management**

- Amend the Toiyabe National Forest Plan (USDA Forest Service 1986) to update the scenery management objectives. These objectives would be a comprehensive update of scenery management direction for key scenic areas, including the U.S. Highway 50 scenic corridor, the lands around well-traveled National Forest System trails, and the lands that form the scenic backdrop for Carson City and Douglas County.



## **7.4 Wildlife Habitats**

### **7.4.1 Sagebrush/Bitterbrush Habitat**

- Implement mule deer habitat improvements in this vegetative cover type, including seeding of fire-damaged lands with sagebrush and planting bitterbrush. Cheatgrass invasion may be a problem after fires; thus, cheatgrass control is essential for habitat restoration with native plant species. The habitat improvement projects could be a collaborative effort between the Forest Service, Mule Deer Foundation, and Nevada Division of Wildlife. Sagebrush habitat improvement areas for mule deer are identified in Map 7-1.

### **7.4.2 Old Forest Habitat**

- Implement habitat maintenance and/or enhancement actions (including mechanical thinning and/or prescribed fire) to protect or improve old forest characteristics and reduce the risk of wildfire in and adjacent to this tree dominated habitat stage. Two old-growth Jeffrey pine stands (approximately 530 acres combined) are currently known to occur on National Forest System lands in the upper reaches of Clear Creek watershed. Old forest habitat protection area is identified in Map 7-1.

## **7.5 Watershed and Roads**

- Coordinate with the Nevada Department of Transportation to implement the proposed watershed mitigation projects in the Clear Creek drainage. To the extent possible, the Forest Service should work with the Nevada Department of Transportation to implement the recommendations proposed in the PBS&J (2003) report for National Forest System lands (see Map 7-2 for locations of proposed projects). The proposed projects would include slope and gully stabilization or construction of sediment retention basins (see Appendix G for details).
- Repair road-stream crossings on Old Clear Creek Road and Kings Canyon Road on National Forest System lands to reduce sedimentation to Clear Creek and Kings Canyon Creek, respectively.
- Implement road maintenance to meet road management and water quality objectives for the Clear Creek/Kings Canyon analysis area. Maintenance efforts for the travelways should be focused on existing road-stream crossings and roads in riparian conservation areas.

## **7.6 Cultural Resources**

- Develop a management, interpretation, and maintenance plan for Kings Canyon Road in consultation with the Nevada State Historic Preservation Office. Nominate Kings Canyon Road for the National Register of Historic Places.
- Create interpretative products focused on logging and transportation during the Comstock era, the roles of Chinese and Basque immigrants in Sierra history, and the use of the area by Native Americans. The interpretive products could include heritage resources website, informational videos and pamphlets, and informative kiosk or signs.

- Establish a stewardship program aimed at monitoring important historic/heritage sites, such as Kings Canyon Road, Clear Creek Road, and Swift's Station.
- In partnership with the University of Nevada in Reno, plan and implement Passport in Time excavations for Swift's Station.
- Develop cultural resources interpretative materials for the lower Kings Canyon loop trails.
- In cooperation and consultation with the Washoe Tribe of Nevada and California, develop management and protection measures for traditional use areas that are located within the analysis area.

## **7.7 Law Enforcement**

- Develop an intergovernmental agreement with Carson City to patrol the future trailheads and parking areas along Kings Canyon Road, the proposed day use area in King's County, and Voltaire Canyon for nuisance activities.
- Increase public education of recreation opportunities and allowable activities. Updated materials on the access plan and allowable uses of the travel routes should be made available to the public. Increased signage and enforcement of rule violations are necessary for control of the nuisance activities to be effective.

## **7.8 Data Needs Related Recommendations**

### **7.8.1 Vegetation, Fire, and Fuels**

- Develop a comprehensive GIS database of appropriate spatial resolution for vegetation, fire, and fuels management. Relevant GIS data may include the following: vegetation types and structural stages, stand density/canopy closure, fire history/patterns and ignitions, fuel types and densities, locations and density of structures/developments in fire defense zone, and locations and accessibility (road condition and speed of ingress/egress) of roads for fire applications. Existing structures/developments distribution and detailed fuel hazard maps can be used for wildfire risk assessment and designing mitigation strategies in the urban wildland intermix zone.
- Complete landscape-scale surveys and mapping to evaluate the status of riparian and aspen forest cover, forest insects and disease, and noxious weeds and undesirable plants.

### **7.8.2 Recreation, Scenery, and Access**

- Complete the classifications and mapping of ROS and VQOs for all National Forest System lands.
- Collect the relevant information on recreation use (types, levels, and quality) for National Forest System lands.
- Inventory and map roads (both classified and unclassified) and trails for use in a roads analysis, and develop a Travel Management Map every 2-3 years.

### **7.8.3 Wildlife Species and Habitats**

- Complete extensive field surveys for selected focal species (e.g., California spotted owl, northern goshawk, flammulated owl, white-headed woodpecker, American marten, and mule deer) in suitable habitats available within the National Forest System lands. The best approximation of potentially suitable habitats for surveys can be completed using vegetation strata coverage and species-habitat relationships.
- Complete vegetation strata classification and mapping that will include vegetation type and structural stage, stand density/canopy closure, site productivity, and past management. The vegetation stratification should be based on 1:15,840 (or higher resolution) color aerial photographs and field verification. Minimum mapping unit should be at least 5 acres in size. Old forest and riparian habitat types must be identified in the vegetation stratification.

### **7.8.4 Roads and Transportation System**

- Conduct an interdisciplinary transportation analysis for roads management to meet public and administrative needs in an environmentally sensitive manner.

### **7.8.5 Cultural Resources**

- Complete landscape-wide field surveys for archaeological sites in unsurveyed areas to develop a comprehensive database to assess the density, types, sensitivity, and conditions of the cultural sites.

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Insert Maps 7-1 & 7-2