Pit Resource
Conservation District

Modoc and Lassen
Counties, California

# PIT RCD WATERSHED MANAGEMENT STRATEGY

## PRIORTIZING MANAGEMENT ACTIONS TO IMPROVE WATERSHED CONDITONS

Issue Date: December 14, 2006

Prepared by:

**Pit Resource Conservation District (RCD)**

TABLE OF CONTENTS

## Introduction

This *Pit RCD Watershed Management Strategy* describes management challenges in the Upper Pit River Watershed and identifies strategies to address those challenges. The Management Strategy was developed based on findings of the *Upper Pit River Watershed Assessment* (VESTRA 2004), stakeholder input, and other existing information. The purpose of the management strategy is to identify principal issues and concerns and align interests in the Pit RCD so that consensus can be reached regarding appropriate watershed and land management actions. Emphasis is placed on opportunities to modify stream channel and landscape conditions to benefit water quality, aquatic habitat, wildlife habitat, range and forest health. Social and economic factors are also considered in the development of the management strategy.

Recognizing that support from stakeholders in the Pit RCD is crucial to the success of this project, development of the strategy included public meetings and presentations to inform stakeholders and receive input. The *Watershed Management Strategy* describes the existing conditions, discusses the primary issues and concerns, and provides management recommendations for projects and other actions to address those concerns. It is anticipated that this management strategy, although focused on a portion of the entire Upper Pit River Watershed, will be useful in the preparation of a strategy for the watershed as a whole (a project soon to be initiated by the Pit River Alliance).

The Pit RCD watershed management strategy is not locked in time. Issues and priorities will change and the strategy will periodically be revisited and updated. The RCD will provide annual reports describing actions and accomplishments in response to the strategy.

Irrigated pastures, and their associated crops production, are important to the agricultural viability of the watershed.

## 1.0 Upper Pit River Watershed

The Upper Pit River Watershed is located in northeastern California primarily in Modoc and Lassen counties. The watershed drains approximately 3,415 square miles, or 2.8 million acres of land that is characterized by juniper and mixed conifer forests, rugged mountains, and broad valleys containing significant wetlands and irrigated farmland. The watershed includes the western edge of the Great Basin geologic province in the east, spans the mainly basaltic volcanic tablelands of the Modoc Plateau, and flows into the Cascade Range geologic province on the western edge of the watershed. The Upper Pit River Watershed ranges in elevation from 9,833 feet above sea level at Eagle Peak Summit in the Warner Mountains in the east to 3,200 feet in Fall River Valley, (the downstream boundary of the upper watershed). Precipitation ranges widely with elevation, higher elevations in the Warner Mountains receive an average of 20-30 inches of precipitation per year, mainly in the form of winter snowfall. In contrast, the alluvial valleys (such as along the mainstream Pit River) are more arid, receiving less than 10 inches of precipitation per year mainly as rain and rapidly melting snow.

The Upper Pit River and its numerous tributaries flow over 4,000 river miles, about one quarter of which are perennial streams (Figure 1). The north and south forks of the Pit River flow from their Warner Mountain headwaters and confluence near the city of Alturas.

Pit River Falls, winter 2006

Pit River Canyon upstream of Fall River Valley

Upon leaving Alturas the Pit River flows southwest through Warm Springs Valley, and Big Valley prior to its confluence with the Fall River near the town of McArthur. Downstream of this upper watershed area, the Pit River flows through a series of PG&E hydropower reservoirs and into Shasta Reservoir. Approximately 2/3 of the annual inflow to Shasta Reservoir comes from the Pit watershed.

Agricultural land, timber, rangeland, and fish and wildlife habitat are highly valuable resources within the Upper Pit River Watershed. The U.S. Forest Service (the largest landowner in the watershed), Bureau of Land Management (BLM), and private industrial timber companies own and manage most of the upper elevation timber and range lands.

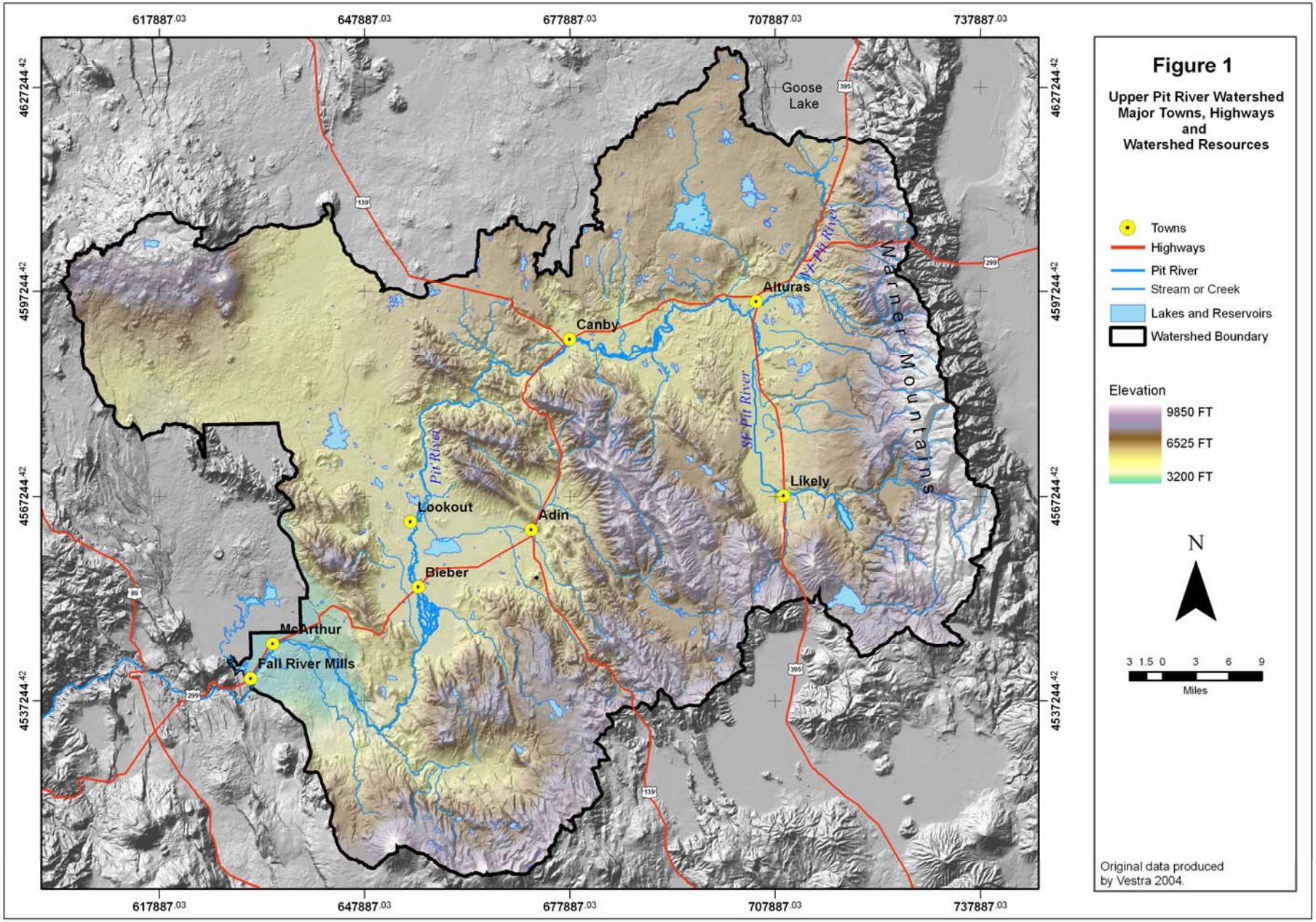
Lower elevation lands are mainly privately owned and used for ranching and farming. Residential use occurs in and around the communities of Alturas, Canby, Adin, Bieber, McArthur and Fall River Mills. Agricultural crops consist of alfalfa hay, wild rice, oats, barley, wheat, and irrigated and non-irrigated pasture for grazing. Cattle ranching and alfalfa production are among the highest grossing agricultural products. To supply and manage these industries, 63 jurisdictional dams divert water primarily for agricultural uses. Because the waters of the Pit River are lowest when irrigation needs are highest (late summer), groundwater resources have been utilized to augment surface supplies. The Upper Pit River watershed contains expansive wetland areas and provides valuable habitat for game species such as mule deer, waterfowl and cold/warm water fisheries. This habitat also supports numerous non-game species including several threatened and endangered (T&E) species. Hunting, fishing, and other recreational uses are important components of the local economy.

## *1.1 Pit Resource Conservation District*

The Pit RCD was formed in the 1940's to address issues pertaining to soil and water conservation. The District (in cooperation with the Natural Resources Conservation Service) provides technical and financial assistance to agricultural producers and promotes vegetation management to benefit stream channel stability and wildlife enhancement. In 1996 the District entered into an agreement with CDFG to contract grazing and farming operations on the Ash Creek Wildlife Area. Most recently, the Pit RCD has expanded its watershed management role and activities. It has secured public grants used to hire a watershed coordinator, conducted monitoring and watershed assessment studies, and implemented on-the-ground projects to improve stream and upland conditions.

The Pit RCD encompasses roughly 732,024 acres of land within the Upper Pit River watershed (Figure 2). Due to the Pit RCD's location in the watershed and its land area it exerts a significant influence on the water and upland resources of the Upper Pit River. Approximately 45% of the RCD land area is privately owned, of which 60% are agricultural and rangelands and 40% are timberlands. The USDA Forest Service and Bureau of Land Management together manage about 50% of the land within the Pit RCD, making cooperation between public and private land management essential to achieve management goals.

The principal tributaries and sub-watersheds to the Pit River located within in the Pit RCD are Ash Creek, Butte Creek, Dutch Flat Creek, Juniper Creek, Rush Creek, Stone Coal Creek, Rose, Turner, and Willow Creeks (Figure 3).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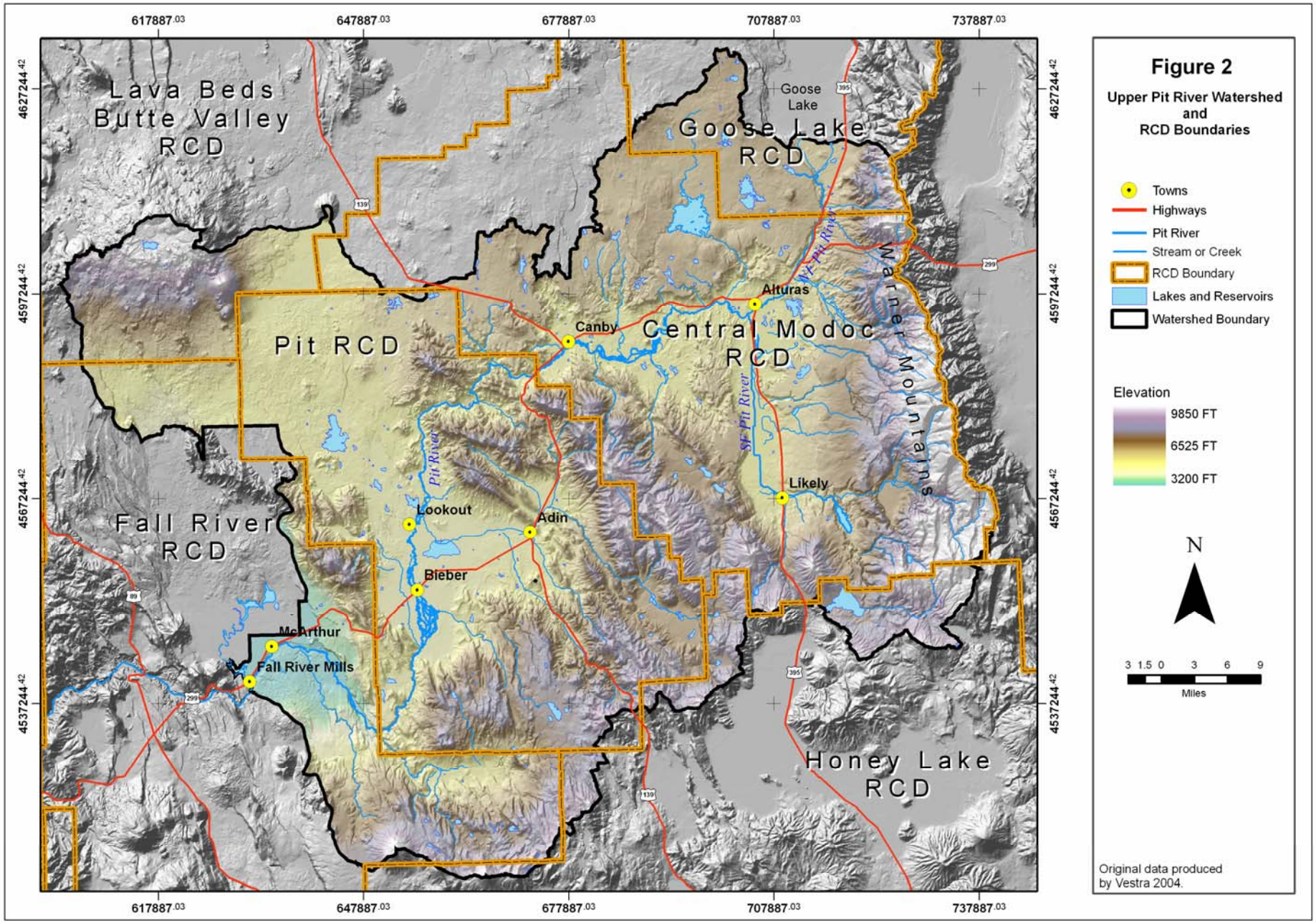
Goose Lake
Alturas
Canby
Likely
Lookout
Adin
Bieber
McArthur
Fall River Mills
Pit River
NF Pit River
SF Pit River
Warner Mountains
139
395
299
89
Figure 1
Upper Pit River Watershed
Major Towns, Highways
and
Watershed Resources
Towns
Highways
Pit River
Stream or Creek
Lakes and Reservoirs
Watershed Boundary
Elevation
9850 FT
6525 FT
3200 FT
N
3 1.5 0 3 6 9
Miles
Original data produced
by Vestra 2004.

Ash Valley

Three large alluvial valleys are located within the Pit RCD (Ash Valley, Round Valley, and Big Valley). Big Valley, the largest of the three, is a key element in the RCD for agricultural and range interests, as well as fisheries and wildlife. Big Valley is a large fault-block basin that historically contained a large lake. Within Big Valley is the 14,000-acre Ash Creek Wildlife Area, which provides natural and man-made habitats for wildlife species including pronghorn, sandhill cranes, and bald eagles. Fishing, hunting, and bird watching draw many people from outside the watershed.

The Pit River winds through the valley floor, providing water for wildlife and for agricultural needs. Over 15,000 acres of Big Valley are irrigated by Pit River waters, mainly through pumps and flashboard structures.

Upper Ash Creek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Lake
Pit RCD
Central Modoc
RCD
Fall River
RCD
Honey Lake
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Warner Mountains
Alturas
Canby
Likely
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McArthur
Fall River Mills
Pit River
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139
395
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Figure 2
Upper Pit River Watershed
and
RCD Boundaries
Towns
Highways
Pit River
Stream or Creek
RCD Boundary
Lakes and Reservoirs
Watershed Boundary
Elevation
9850 FT
6525 FT
3200 FT
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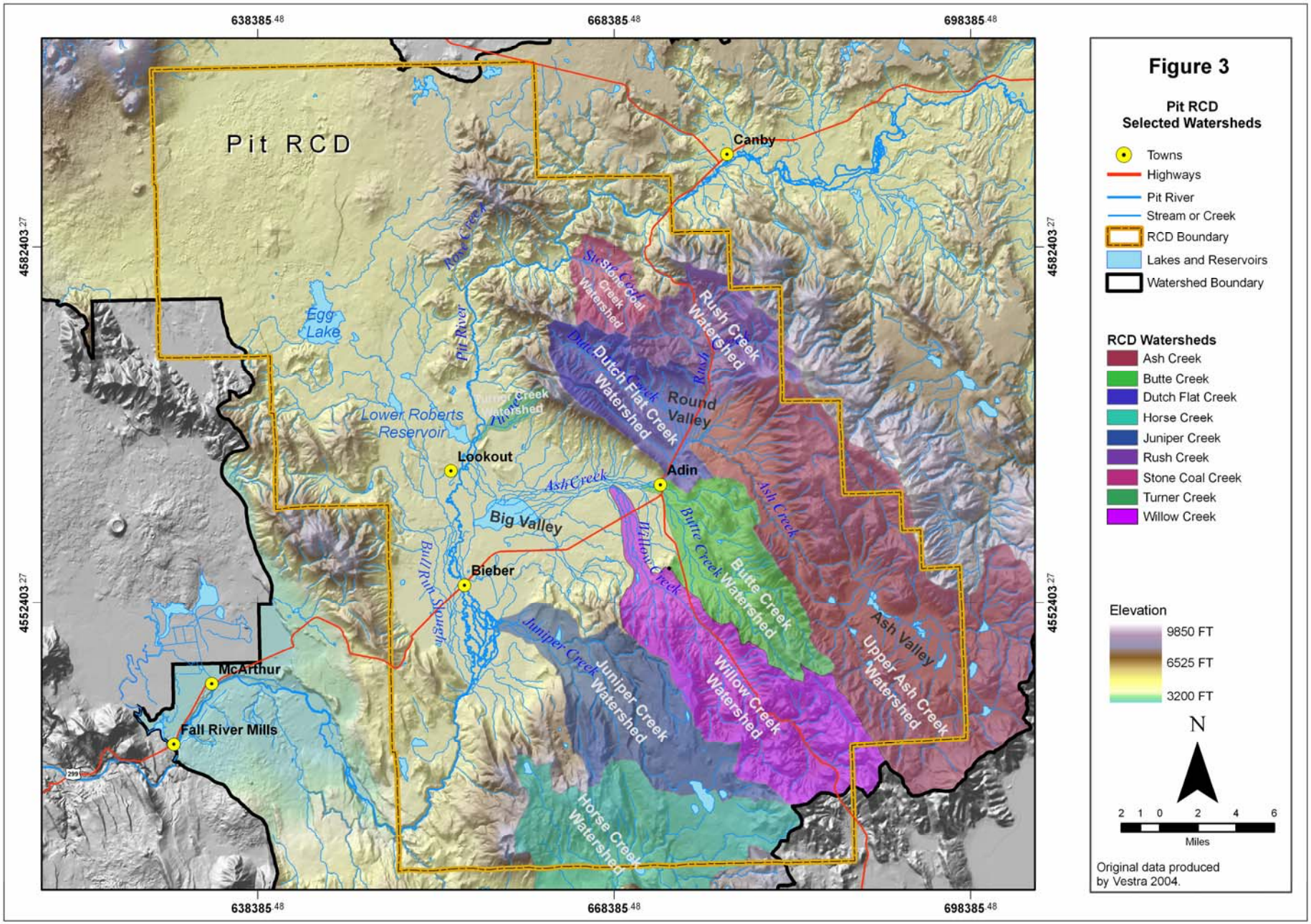
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Pit RCD
Canby
Rose Creek
Egg Lake
Pit River
Stone Coal Creek Watershed
Rush Creek Watershed
Dutch Flat Creek Watershed
Round Valley
Turner Creek Watershed
Lower Roberts Reservoir
Lookout
Adin
Ash Creek
Big Valley
Willow Creek
Butte Creek Watershed
Ash Valley
Upper Ash Creek Watershed
Bieber
Bull Run Slough
Juniper Creek
Juniper Creek Watershed
Willow Creek Watershed
McArthur
Fall River Mills
299
Horse Creek Watershed
Figure 3
Pit RCD
Selected Watersheds
Towns
Highways
Pit River
Stream or Creek
RCD Boundary
Lakes and Reservoirs
Watershed Boundary
RCD Watersheds
Ash Creek
Butte Creek
Dutch Flat Creek
Horse Creek
Juniper Creek
Rush Creek
Stone Coal Creek
Turner Creek
Willow Creek
Elevation
9850 FT
6525 FT
3200 FT
N
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Miles
Original data produced
by Vestra 2004.

## 2.0 Watershed Condition and Management Strategy

Turner Creek. Lack of shade canopy, together with wide shallow channel contributes to higher temperatures in streams.

This section includes a discussion of the principal issues and concerns with regard to overall watershed condition in the Pit RCD, together with management actions to address those concerns. The list of issues and concerns is based on the results of the Pit River Watershed Assessment, other related studies and reports, and input from the watershed community. Although watershed issues and concerns are discussed separately in the sections that follow, it should be recognized that the factors impacting overall watershed condition are highly interrelated (e.g. water quantity affects water quality, juniper expansion affects water quantity, and stream channel stability affects aquatic habitat quality).

Potential projects that have been discussed between the Pit RCD and private landowners are included in Appendix A – Projects of the Pit RCD.

## 2.1. Water Quality

Algae mats in Pit River. Nutrients, together with warm temperatures and stagnant flow cause excessive growths of weeds and algae.

### 2.1.1. Existing Conditions and Assessment Conclusions

The Water Quality Control Plan for the Sacramento River Basin, which includes the Pit River watershed, specifies Beneficial Uses for individual waterbodies and water quality objectives required for protection of those uses. Beneficial Uses listed for the Pit River include the following:

- municipal supply
- agricultural supply
- contact and non-contact water recreation
- warm water aquatic habitat
- cold water aquatic habitat
- wildlife habitat

The Pit River is currently listed as impaired (per section 303(d) of the Federal Clean Water Act) due to the finding that selected water quality constituents are at levels which are not protective of one or more of the above beneficial uses. The identified constituents of concern are temperature, dissolved oxygen, and nutrient loading. While not a part of the 303(d) listing, turbidity and suspended sediment are known to be at relatively high levels in the Pit watershed and are at levels which impact recreation and aquatic life uses.

Water quality data for the Pit River and tributaries is available primarily from the following sources:

- Pit River Water Quality Study (1980, CA Dept. of Water Resources)
- Pit River Water Quality Monitoring Study (2001-2002, CA RWQCB)
- Pit River Watershed Monitoring Program (2003-2005, Pit River Alliance)

**Temperature** – Over the past several years, substantial data has been collected to define the annual temperature regime in the Pit River and selected tributaries. The data shows that temperatures in the Pit River and in the lower reaches of most tributaries are seasonally not suitable for cold water species (trout). Most tributaries do provide cold water habitat in their upper reaches. There is debate and uncertainty as to whether or not the Pit River historically supported significant numbers of cold water species. There is also the question of whether trout do or could use certain reaches of the Pit River seasonally to support important life stages. Conditions affecting water temperature in the Pit River watershed include ambient air temperature, riparian habitat condition (shade canopy), stream flow, and irrigation discharges. Since stream temperature is frequently an important limiting factor for cold water habitat in this watershed, management strategies should include actions to maintain or enhance stream temperature conditions.

Pit River in FRV. Irrigation pasture runoff can cause elevated water temperature, bacteria, and nutrient loading.

Fine sediment and algae accumulate on the Pit River substrate. Combined with high turbidity, this impacts aquatic organisms and overall biological diversity in the river.

**Dissolved Oxygen** - Water quality objectives for dissolved oxygen (DO) are not less than 7.0 mg/l in waters supporting cold water species and not less than 5.0 mg/l in waters supporting warm water species. Past monitoring has shown that during the summer season, DO levels in the Pit River commonly fall below 5.0 mg/l. Excessive growths of weeds and algae in the River is the principal cause of the low DO. Oxygen levels vary over a 24 hour period, being high in the daytime when plants use CO2 from the atmosphere and produce O2, and low during the night time when this process is reversed. The biological affects of this daily variation in DO level is not completely understood, but at a minimum it is believed to be a significant stress factor for aquatic life. Other important factors affecting DO concentrations are temperature (warm water holds less oxygen) and flow (water movement and turbulence causes aeration and increases DO).

**Nutrients** – Water Quality Control Plan objectives state that nutrient concentrations shall not promote growth of weeds and algae to nuisance levels that adversely impact beneficial uses. As previously discussed, nutrient levels in the River do promote plant growth which seasonally cause dissolved oxygen depletion. There have also been complaints regarding weeds and algae clogging irrigation devices. Principal sources of nutrients in the watershed are believed to be decaying vegetation, fecal matter from livestock and wildlife, and fertilizers.

Currently, it is not known which specific nutrients are causing accelerated plant and algae growth in the River. Total phosphorus levels in the watershed are high relative to most other north state rivers and streams. Nitrate nitrogen levels in the water are relatively low. However, this may indicate that nitrogen, and not phosphorus, is the principal nutrient controlling plant growth in the River (i.e. dissolved nitrate is rapidly taken out of the water column and converted to plant growth). Further analysis is needed to better understand the principal sources of nutrients and their role in promoting weed and algae growth in the Pit watershed.

**Sediment** – Turbidity and suspended sediment levels in the Pit watershed are known to be high relative to other north state waters. This condition is partially natural due to deposits of fine grained volcanic soils on the valley floor. Sediment and turbidity levels are exacerbated by stream and river channel erosion, which is common throughout the watershed. Sediment impacts include a decrease in the recreational and aesthetic quality of the River, aquatic life impairment (bottom dwelling organisms and spawning habitat are affected by sediment deposits), and impacts to agricultural irrigation activities.

**Bacteria** – E-coli and fecal coliform bacteria concentrations in the Pit River and tributaries occasionally exceed water quality objectives established for protection of contact recreation. Water contact recreation in the watershed is not common, however it does occur and efforts should be made to minimize introduction of pathogens into surface waters. Domestic livestock and wildlife are considered to be the principal sources of bacteria to surface waters in this watershed.

**RWQCB Irrigation Discharge Requirements** – The Regional Water Quality Control Board now requires landowners/operators that discharge irrigation tailwater to rivers and streams (in this case, the Pit River and tributary streams) to apply for a waste discharge permit or seek coverage as part of a watershed wide coalition. Within the Pit RCD area, those seeking compliance with this requirement have joined the Pit River Coalition organized and operated by the Northeastern CA Water Association (NECWA). NECWA collects fees from coalition participants and conducts water quality monitoring at selected sites in the watershed. The RWQCB is considering alternatives to the current irrigation discharge program with a goal of providing more incentive and reward for landowners who implement best management practices.

Pit River near Stone Coal Valley. Low summer flow in the Pit River impacts water quality, aquatic life, and downstream agriculture users.

Beaver Creek at Pittville. Pit River tributary at flood stage in January 2006. Degraded watershed conditions contribute to peak runoff from storm events causing flood damage, channel erosion, and property loss.

Pit River Dam. Water impoundment structure along Pit River used to raise water levels in the river during the summer to irrigate pastures and crops.

### 2.1.2. Management Strategy

A. The Pit RCD will support implementation of projects, which have direct or indirect benefits to water quality conditions in surface waters of the District. Priority projects include the following:
   - projects which improve stream side vegetation and shade canopy to benefit water temperature
   - projects which stabilize eroding stream channels to reduce turbidity levels, sediment discharge, and sediment deposition
   - projects which improve water quality through better management of livestock such as fencing and off-stream water facilities
   - projects which mitigate direct discharge of irrigation return flows and serve to reduce loadings of nutrients, bacteria, and high temperature
   - projects which enhance instream flow (see discussion on Water Quantity)

B. The RCD will seek funding and implementation of a basic water quality monitoring program in the District that will provide a continuing evaluation of water quality conditions at selected sites and provide a basis for determination of long term trends.

C. The RCD will encourage participation in the CA RWQCB Irrigated Lands Discharge Program provided that the program includes the following components:
   - minimal cost to individual landowners and local retention of discharge fees to support watershed improvement work within the Pit watershed
   - program compliance based on development of individual ranch/farm conservation plans with oversight by local agricultural technical service providers
   - compliance via one program addressing all potential ranch/farm water quality concerns (as opposed to separate programs for irrigation discharge, livestock management, erosion control, etc).

## 2.2. Water Quantity

### 2.2.1 Existing Conditions and Assessment Conclusions

Irrigation agriculture (primarily pasture and hay production) is the largest water user in the Pit River watershed. Approximately 230,000 acre-feet of surface water is annually diverted for this purpose. These diversions, together with the natural precipitation and stream flow patterns in this area, result in seasonal low flow (or no flow) in the Pit River and some tributaries during the summer and early fall months. This condition is in part mitigated by winter storage of wet season runoff and release of that water through the irrigation season. Seasonal low flow in many of the watercourses impacts water quality, aquatic habitat, recreation, and agricultural uses within the Pit RCD area.

In addition to variations in natural precipitation (which cannot be influenced by the management strategy), the following are factors, influence seasonal instream flow:

- Entrenched (gullied) stream channels which quickly transport wet season runoff out of the watershed, prevent high flows from accessing and rewatering meadow systems, and act as a drain on those water storing meadow systems. This condition works toward reducing dry season base flow in the River and tributary streams.
- Proliferation of undesirable and/or overly dense vegetation in the upland areas (e.g. the juniper problem) which use water that would otherwise be available in springs, wet meadows and streams.
- Inefficient transport and use of water for irrigation resulting in surface water diversions which are in excess of that actually needed for the irrigation use.

Channel entrenchment and erosion on Rush Creek

Channel erosion, Pit River near Lookout.

Severely entrenched channel on a Pit River tributary.

### 2.2.2 Management Strategy

A. The Pit RCD will seek to implement projects which result in augmentation of instream flows, particularly during the critical summer dry season. This includes:

- projects which improve natural stream and floodplain function resulting in improved water retention during the wet season and slower release of wet meadow storage during the dry season
- projects which work towards managing timber and other upland vegetation in a more healthy and natural condition resulting in an overall decrease in surface and groundwater demand by these upland species
- projects which increase irrigation use efficiency and dedicate saved water for instream flow purposes
- projects which retire existing consumptive uses and dedicate saved water for instream flow purposes
- projects which increase capacity for wet season storage and dry season release of stored water via instream flow

## 2.3 River and Stream Channel Erosion

### 2.3.1. Existing Conditions and Assessment Conclusions

Accelerated erosion of channel banks on the Pit River and tributary streams is a significant concern throughout the Pit RCD watershed area. Causes of this erosion are varied and can be related to natural factors such as catastrophic wildfire and floods, or land and water management practices such as intensive livestock grazing and channel modification (e.g. channel straightening and poor bridge designs). The Pit River from Canby to McArthur has many reaches with relatively severe and active channel erosion. This is also true for some of the principal tributaries such as Ash Cr, Willow Cr, Rush Cr and Stone Coal Cr. Active channel erosion results in property loss, threatens infrastructure (i.e. roads and bridges), degrades water quality, degrades aquatic habitat, and impacts recreation and the general aesthetics of the watershed.

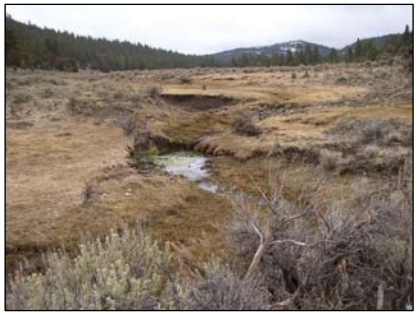
The Pit RCD, together with its service partner NRCS, has provided technical and financial assistance to landowners who wish to address problems of stream bank erosion. Many projects have been implemented, in part to demonstrate and evaluate techniques to reducing or controlling channel erosion.

### 2.3.2. Management Strategy

A. The Pit RCD will seek to conduct an overall survey and ranking of stream channel erosion problems in the district.

B. The RCD and NRCS will continue to provide technical and financial assistance to landowners who want to address accelerated stream bank erosion. Potential funding sources for this activity include state and federal watershed improvement grants, various provisions of the federal Farm Bill, and other public/private sources.

C. The RCD will promote stream bank erosion control projects which will emphasize low cost, low maintenance approaches over costly hard fixes like rip rap and dams. Projects will attempt to restore natural functioning condition of the watercourse (i.e. utilize historic remnant channels and restore floodplain connection). Priority will be given to projects with high demonstration value. These are projects which address erosion causes and symptoms common and widespread in the watershed and projects where the techniques and resulting benefits can be readily viewed by the public.



Entrenched channel in Willow Creek meadow. Impacts meadow hydrology and forage quality.

Severe gully erosion on Rose Creek.

Channel erosion on Pit River at Shaw Ranch.

Bank stabilization at Shaw Ranch using rock vanes, bank reshaping, and willow planting.

Pit River channel stabilization near Canby (Bushy Ranch) using rock, willow plantings, juniper rootwads, and livestock fencing.

Pit River near Canby (Bushy Ranch)

Pit River near Canby (Bushy Ranch)

# Illustration of Channel Geomorphology and Change Overtime Due to Watershed Degradation

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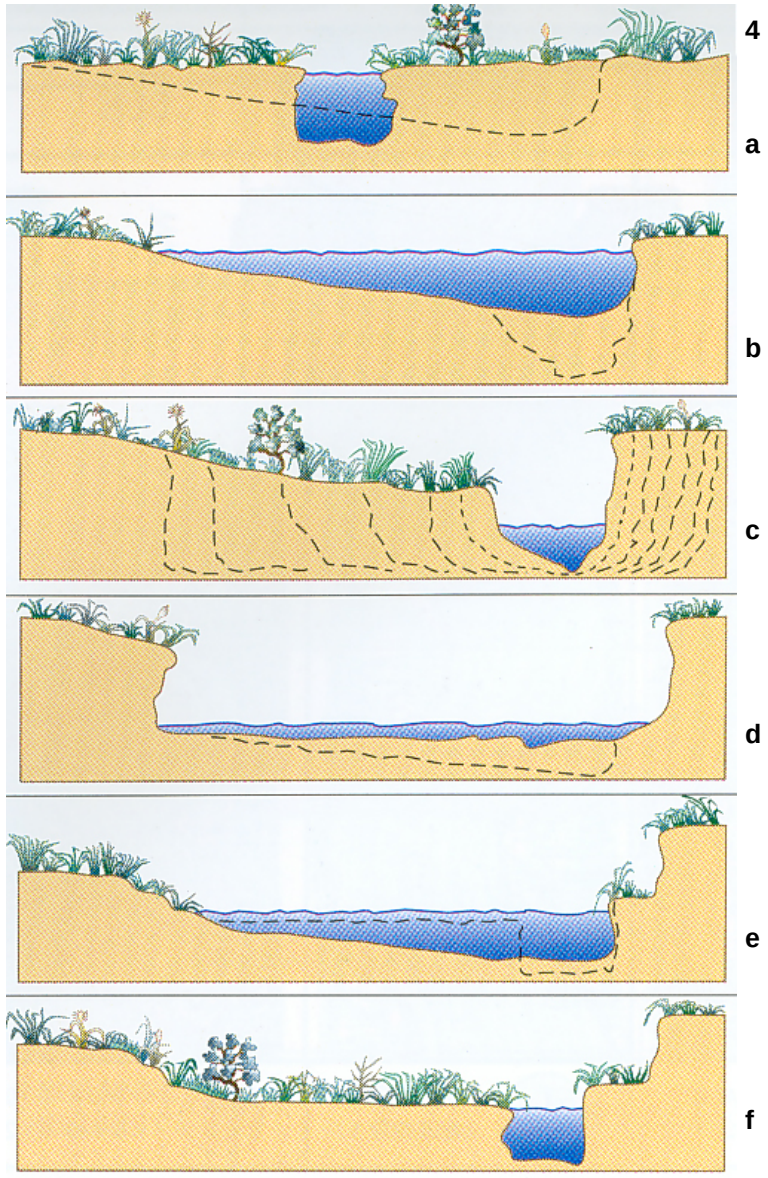


**Figure 4**

1. Photo of headcutting and erosion

2. Photo of headcutting and incised channel

3. Photo of erosion in tributary channels

4. Illustration of channel geomorphology and change overtime due to watershed degradation

4a. Valley bottom stream channel

4b. Loss of vegetation causes instability of banks leading to erosion

4c. The channel bottom begins to erode down (headcutting) and leaves banks high and vertical

4d. Steep cutbanks slough off into the channel causing increased sediment loads and bank undercuts

4e. Laidback and stepped channel profile begins to stabilize as vegetation holds the streambanks

4f. Inset stream channel. The stream is now functioning within the historic channel with decreased baseflow and riparian vegetation management and protection.

Note on illustrations:
Photos 1,2, and 3 and Illustration 4 are from: Rosgen, D. 1996. *Applied River Morphology*. Printed Media Companies Minneapolis, Minnesota.

## 2.4 Aquatic and Wildlife Habitat

### 2.4.1 Existing Conditions and Assessment Conclusions

One of the most valuable resources within the Pit RCD area is open space allowing for quality and quantity of habitat for fish and other aquatic species, waterfowl, and a wide variety of game and non-game wildlife species. In a state of 30 million people and growing, this is a valuable and shrinking resource. Past and current land management (irrigation agriculture, logging, grazing, roads, fire control, etc) have impacted habitat conditions in both positive and negative ways. However, due mainly to the large and undeveloped nature of the landscape, habitat value remains high and there are many opportunities to improve this condition.

The 14,000 acre state owned Ash Creek Wildlife Area is of particular significance with regard to habitat quality and quantity. Extensive riparian areas and wet meadows on both public and private lands are also important habitat features. Healthy conditions in the sagebrush steppe, juniper, aspen and conifer stands are important for a wide variety of terrestrial species. Irrigated pasture, hay fields, and other crop lands provide food, cover, and resting area for species such as mule deer, pronghorn, sandhill cranes, and bald eagles. The RCD will strive to protect and enhance open space and habitat quality in the District.

### 2.4.2 Management Strategy

A. The RCD will promote the continued open space, agricultural nature of the landscape based on its value for habitat quality and quantity. Efforts to convert lands to other 'development' oriented uses will be discouraged.

B. Farm Bill programs such as WRP, CRP, CSP and EQIP will be supported through technical and financial assistance, Community education, and outreach activities will emphasize habitat value and will discuss options for habitat preservation or enhancement (e.g. conservation easements).

C. The RCD will continue in a partnership with the Dept. of Fish and Game to see that the Ash Creek Wildlife Area is managed in a way that uses production agriculture to contribute to the waterfowl and wildlife habitat value of this property.

D. The RCD will partner with agencies and landowners to improve upland vegetation conditions in a way that improves habitat quality and quantity. Management options include grazing management, fire, road restrictions, and removal of undesired vegetation species.

## 2.5 Juniper Expansion and Sagebrush Steppe/Forest Restoration

### 2.5.1. Existing Conditions and Assessment Conclusions

The ecological communities of the Upper Pit River watershed have changed drastically over the past 150 years. The reasons for these changes are both natural and human caused: climate, fire suppression, invasive exotic plants, agriculture, timber harvest, and livestock grazing management. One community that has experienced significant change in the recent past is western juniper, which is the dominant species for approximately 20% of the Upper Pit River watershed and is rapidly expanding throughout much of the watershed area.

Degraded aquatic habitat on Turner Creek.

Good riparian and aquatic habitat conditions on Turner Creek.

Poor aquatic and riparian habitat conditions on Pit River near Bieber.

Stable channel and good riparian habitat on Pit River near Lookout.

Good riparian and aquatic habitat quality along Willow Creek.

Mid to late successional stage of sagebrush steppe conversion to juniper woodland: Note bare ground and dead remnant shrub community. Photo courtesy of Dr. Richard Miller, Oregon State University

A vibrant and healthy sagebrush steppe complex like this one in the Willow Creek watershed is necessary for wildlife to prosper.

BLM/USFS Juniper Management Strategy estimates that this translates into a conversion of sagebrush steppe and forest to juniper woodland at the rate of 50,000 acres a year in northeast California.

The concurrent histories of grazing management and fire suppression have likely facilitated the spread of juniper. Grazing management practices have decreased the amount of fine fuels (grasses and ground cover) which in turn has decreased the frequency of fire in sagebrush steppe and forest ecosystems, thus allowing juniper to expand its range. A century of fire suppression as a management practice has also allowed juniper to expand, as juniper regeneration is particularly susceptible to fire until it reaches 50 years of age. Natural fire return intervals in the Upper Pit River Watershed are 15–20 years. Juniper expansion likely would have been minimized if fire had been allowed to occur and burn seedlings and saplings.

The ecological effects of juniper expansion into other vegetation communities are problematic and include the alteration of local fire disturbance and hydrologic regimes, displacement of sagebrush and other vegetation, and adverse impacts to wildlife habitat for some species including sage-grouse, mule deer, and a recently expanding elk population. Although evidence exists, mainly from Texas, that juniper expansion has a deleterious effect on water quantity in rivers, only anecdotal information exists on the affects of western juniper to water quantity in Northeast California. There are numerous accounts, including those in recent Pit RCD partner projects, where springs that have been dry for decades began flowing again after juniper removal treatments. Regardless of the effect of juniper on stream flow and soil properties, its expansion into sagebrush steppe communities is problematic for grazing and agriculture.

The climax condition of the expanding juniper community can become one of complete juniper dominance where virtually all other forbs and forage disappear and springs dry up. The steady conversion of rangeland, forest and wildlife habitat in general to juniper woodland is deteriorating natural resources within the district. Juniper removal treatments are a sound practice used to achieve sustainable range management, hazardous fuel reduction and wildlife habitat improvement. Since grazing, forestry and agriculture are major economic activities in the Pit RCD it is economically advantageous to control juniper expansion.

Juniper dominates portions of the following sub-watersheds of the Pit RCD: Ash Creek, Stone Coal Creek, Widow Valley Creek, Taylor Creek, Willow Creek, Juniper Creek and along the main stem of the Pit River downstream of Canby. Currently within the Pit RCD, juniper removal and sagebrush steppe restoration work is underway. The Cooperative Sagebrush Steppe Restoration Initiative, which includes the Pit RCD, Susanville Indian Rancheria, Lassen County Fire Safe Council, Inc., University of California Cooperative Extension and Burney Forest Power, is working to restore forest and sagebrush ecosystems through the removal of invasive western juniper and the application of adaptive management techniques. The premise for the cooperative is that the encroachment of western juniper into the sagebrush steppe and forest is widely acknowledged as the single factor having the greatest impact on ecosystem and watershed health in the region and is a significant contributor to hazardous fuel loads**.**

### 2.5.2. Management Strategy

A. The Pit RCD will support treatment projects that reduce western juniper stands to pre-European settlement levels and restore our sagebrush steppe and forest ecosystems to healthy conditions. Priority projects include the following:

- treatment projects that reduce hazardous fuel loads within the Wildland Urban Interface (WUI)
- treatment projects of a broad landscape scale that further reduce hazardous fuel loads, enhance wildlife habitat and restore watershed function
- establishment of a "grass bank" where producers can move their stock while landscape scale projects are implemented and while the site is recovering
- cross boundary treatments in conjunction with our State and Federal partners
- support for the BLM and US Forest Service juniper planning and treatment efforts

| Family | Scientific Name | Status |
|---|---|---|
| **Sunflower Family** | | |
| **Thistles** | | |
| Scotch Thistle | Onopordum acanthium | A Rated |
| Yellow Starthistle | Centaurea solstitialis L. | A Rated (Lassen County) |
| **Knapweeds** | | |
| Diffuse Knapweed | Centaurea diffusa | A Rated |
| Squarrnose Knapweed | Centaurea squarrosa | A Rated |
| **Mustard Family** | | |
| Dyer's Woad or Marlahan Mustard | Isatis tinctoria | |
| Hoary Cress (Short Whitetop) | Cardaria draba | |
| Perennial Pepperweed (Tall Whitetop) | Lepidium latifolium | A Rated |
| **Families represented by only one weed** | | |
| Puncturevine | Tribulus terrestris | B Rated |

**Table 2.6. Invasive Plants and Noxious Weeds**

## 2.6 Invasive Plants and Noxious Weeds

### 2.6.1. Existing Conditions and Assessment Conclusions

California's varied topography, geology, and climate enables many exotic plants to colonize and become established. These invasive plants and noxious weeds are a serious threat to the State's biodiversity and native habitats. Invasive plants are problematic because they adversely impact native vegetative communities by altering patterns of nutrient cycling, hydrological processes, and the intensity of fire.

The Pit RCD and Upper Pit River Watershed are infested with invasive plants and noxious weeds. The Lassen and Modoc County Agricultural Commissioners maintain a list of California Department of Food and Agriculture (CDFA) rated invasive plants known to occur in Modoc and Lassen Counties (Table 2.6). Many of the weeds in Table 2.6 occur in the Pit RCD and are negatively affecting the watershed condition of the area.

There are presently weed control projects underway in Modoc and Lassen Counties, some of which occur in the Pit RCD. Most notably, amongst these weed control projects, is the elimination of Scotch thistle in the Big Valley Area. Scotch thistle, like many invasive plants, is a native of Europe and eastern Asia and is probably an escaped ornamental. Scotch thistle stands are dense and practically impenetrable due to the weed's spiny nature and large size. Dense stands of Scotch thistle prohibit the colonization and establishment of native vegetation, thus negatively affecting the overall condition of the watershed.

Another noxious weed of major concern within the Pit RCD is the recent emergence of small plots of Perennial Pepperweed, also known as Tall Whitetop, in the Big Valley and Ash Valley areas. Tall whitetop is an extremely invasive weed that quickly spreads by root fragments and seed. Population's form large, monoculture stands that crowd out desirable vegetation, compete with desirable crops, and alter ecosystem function including soil properties and the hydrologic cycle. Recent statewide surveys identify tall whitetop as one of the top five weed problems in California, and both the California Department of Food and Agriculture (CDFA) and California Invasive Plant Council (Cal-IPC) list it as a noxious weed of greatest ecological concern.

- *Impacts on Agriculture*: Tall whitetop is threatening the viability of Lassen County's agriculture by decreasing grazing land productivity, hay quality, hay marketability, and forage yields. Management of tall whitetop also increases agricultural producers' annual weed control costs decreasing profit margins and land-value.

- *Impacts on Wildlife and Natural Resources*: Tall whitetop threatens habitat for several waterfowl, mammal, and insect species by dramatically altering plant community make-up. The dense, monoculture populations also interfere with waterfowl nesting and wildlife movement.

There are currently three agencies that bear responsibility for the treatment and control of noxious weeds within the Pit RCD. They are the Lassen and Modoc County Agricultural Commissioner Offices and the Big Valley Pest Abatement District.

### 2.6.2. Management Strategy

A. The Pit RCD will work with the responsible weed control agencies to educate landowners on the need to take action to control noxious weeds.

B. The Pit RCD will encourage producers and landowners seeking cost share assistance to include pest management practices in their contracts.

C. The Pit RCD will require and include noxious weed monitoring and follow up treatment in all projects that involve ground disturbing activities in which they participate.

D. The Pit RCD will work with partner agencies and with partnerships to obtain needed funding for noxious weed treatment and control.

## 2.7 Fire and Fuels

### 2.7.1. Existing conditions and Assessment Conclusions

Fire is a dominant and natural characteristic of the California landscape. The combination of climate, terrain, and vegetation produces one of the most combustible natural fire environments on earth. Prior to European settlement fires were frequent occurrences in California. Fire scar records derived from tree ring data demonstrate that historic fire-return intervals were variable ranging from as low as 4 years to over 20 years. Following European settlement, specifically in the last 100 years, fire suppression was implemented as a management practice.

Modoc Sucker Habitat on Dutch Flat Creek. Example of small aquatic pools during summer in Pit River tributaries that support Modoc Sucker.

Vernal Pools. Vernal pools support unique plants and invertebrates, provide valuable habitat for wildlife during migration periods, and help recharge groundwater.

Over time, commercial logging and the suppression of fire have resulted in conversion of forests with open crown canopies, dominated by large trees, to dense closed crown stands of smaller trees. Fire suppression enabled brush, juniper and some non-native species to invade lowland and coniferous communities. This change in California's vegetation communities, from open forests, woodlands, and meadows to dense young stands of trees and brush, has significantly increased the amount of fuels and the risk of catastrophic fire.

The California Department of Forestry and Fire Protection (CDF) identified areas within the Upper Pit River Watershed, and thus within the Pit RCD, where the abundance of fuels and environmental conditions (topography, vegetation, and climate) are rife for catastrophic fire. Catastrophic fires, generally referred to as stand-replacement fires, are problematic for watersheds as they cause severe erosion due to loss of vegetation, sediment loading in rivers and streams, reduced retention of water in the upper watershed, poor air quality, loss of forage and rangeland, loss of timber, and loss of wildlife habitat.

While the forest industry has declined in recent years there is much work to be done to make our forests healthy. Forest improvement projects offer significant employment opportunities for our community while at the same time making our watershed healthier and our communities safer. Both Lassen and Modoc Counties have adopted Community Wildfire Protection Plans (CWPP) that have established priorities for fuel treatments.

### 2.7.2 Management Strategy

A. The Pit RCD will support fuel treatment and forest health projects that reduce hazardous fuel loads with the long term goal of the establishment of open crown stands of large trees. Priority projects include the following:

- Treatment projects that reduce hazardous fuel loads within the Wildland Urban Interface (WUI) and meet the goals of the Lassen and Modoc County CWPPs.
- Treatment projects of a broad landscape scale that further reduces hazardous fuel loads and enhances wildlife habitat and restores watershed function.
- Encouragement and support of cross boundary treatments in conjunction with our State and Federal partners.

## 2.8 Threatened And Endangered Species

### 2.8.1. Existing Conditions and Assessment Conclusions

Threatened and endangered species (both botanical and wildlife species) are closely linked to watershed health and function, and therefore must be treated as an integral part of the watershed management strategy. Vegetation and habitat conditions within the Pit River watershed have changed significantly over the last 150 years. These changes, which impact species composition, diversity, and density, have resulted from a variety of factors including disruption of natural fire regime, grazing, logging and agricultural practices, introduction of non-native invasive species, and modifications of stream channels and hydrology. As a result, several species within the Pit RCD area are now state or federally listed as threatened or endangered. Table 2.8 includes an identification of those species, their listing status, preferred habitat, and cause for decline.

| Species | Listing Status | Preferred Habitat | Cause of Decline |
|---|---|---|---|
| **Modoc Sucker** | *U.S. Endangered CA Endangered* | Small, partially shaded, permanent streams with low flow (about 113 cm/sec), in forested areas with good riparian vegetative cover; large, shallow, muddy-bottomed pools; and moderately clear water less than 25 C. | Drought; hybridization with the introduced Sacramento Sucker; population isolation; reduced pool habitat due to channelization; reduced stream flows and increased temperatures due to irrigation diversions; and predation by large-mouthed bass and exotic brown trout. |
| **Bald Eagle** | *U.S.Threatened CA Endangered* | Breeding habitat includes water bodies that provide primary food sources including fish, waterfowl, and seabirds. Preferentially roosts in conifers or other sheltered sites in winter typically selecting larger, more accessible trees | Habitat loss, disturbance by humans, biocide contamination, decreasing food supply, and illegal shooting |
| **Willow Flycatcher** | *CA Endangered* | Presence of water (running water, pools, or saturated soils) and dense riparian deciduous shrub cover (willow, alder, or other deciduous riparian shrubs) separated by open areas. | Habitat loss and alteration from high-intensity livestock grazing, recreation and development pressure, non-native invasive plants, alteration of natural hydrology, and brood parasitism by brown-headed cowbirds. |
| **Greater Sandhill Crane** | *CA Threatened* | Breeding habitats include isolated bogs, marshes, swamps and meadows, and other secluded shallow freshwater wetlands generally >1 ha in size surrounded by forest cover. | Poor recruitment; intensive grazing operations, especially when mowing is used; loss and degradation of wetland habitats; collisions with powerlines; nest and chick predation by ravens, coyotes, and raccoons. |
| **Swainson's Hawk** | *CA Threatened* | Savanna, open pine-oak woodland and cultivated lands (e.g., alfalfa and other hay crops) with scattered trees. Nests in solitary tree, bush, or small grove; many nests on old black-billed magpie nests; sometimes on rock ledge. | Expansion of cropland unsuitable for foraging and residential and commercial development in former agricultural and grassland areas. Widespread use of pesticides and rodenticides throughout the range is cause for concern. |
| **Sierra Nevada Red Fox** | *CA Threatened* | Various habitats in alpine and subalpine zones; prefers red fir and lodgepole pine forests and alpine fell-fields; hunts in forest openings, meadows, and barren rocky areas. Dens are likely to be in rock slides. | Logging, recreation, and cattle grazing have potentially adverse impacts that have not been adequately addressed in forest management plans (California Department of Fish and Game 1990). |
| **Slender Orcutt Grass** | *U.S Endangered CA Endangered* | Vernal pools on remnant alluvial fans and high stream terraces and recent basalt flows; has some ability to colonize artificial habitats, such as the margins of stock ponds. | Loss of habitat from urbanization, agricultural conversion and mining, habitat alteration and degradation as a result of changes to natural hydrology, invasive species, incompatible grazing regimes, infrastructure projects, recreational activities, erosion, contamination and inadequate management and monitoring. |
| **Boggs Lake Hedge-Hyssop** | *CA Endangered* | Vernal pools, reservoir edges, and mudflats where wet, clay soils are present. | Drought, intensive grazing, invasion by weedy upland species, development impacts, and hydrologic alteration. |

**Table 2.8. THREATENED AND ENDANGERED SPECIES WITHIN THE PIT RCD**

In addition to the above, there are several animals identified by the State as species of special concern. Of particular concern is the Greater Sage-Grouse. Historically, numerous leks (breeding grounds) were located throughout the Pit RCD boundaries, but now only one lek is known to be active and sage grouse are rarely sited.

### 2.8.2. Management Strategy

A. The Pit RCD will work to preserve the rural, open space nature of the watershed which, in general, will contribute to the preservation and enhancement of T&E species.

B. As described in Section D, Aquatic and Wildlife Habitat, the Pit RCD will implement projects focused on habitat protection and enhancement. Projects which have benefits for habitat used by T&E species will be given added priority.

C. The Pit RCD will continue its partnership role in the Cooperative Sagebrush Steppe Restoration Initiative. Among other benefits, this project is expected to improve habitat conditions for sage grouse breeding.

**Bacigalupi Ranch**
Healthy riparian vegetation along the inward side of the river system.

**Bacigalupi Ranch**
Erosion has exposed the water conveyance system.

**Mason Ranch**
Inset channel along the Mason Ranch

# Appendices

## Projects List of the PIT RCD

**Bacigalupi Ranch:**
Jerry and Donna Bacigalupi own roughly 400 acres along the Pit River in Lassen and Modoc County. The portion of the river that meanders through their ranch is incised, as it has down cut between 10 and 15 feet. The incised channel has damaged their water conveyance system and is threatening their residence. Currently, a narrow walkway remains between the river and their backyard fence. Jerry estimates that the river erodes between one and two feet of soil each year on the outward bends of the river. A water control structure and conveyance system installed in the mid 1980's is eroding and no longer operational (see figure at left). The Bachigalupi's farm is roughly 200 acres primarily used for hay production, as they do not graze livestock on their property. A dense riparian corridor has developed along the inward banks of the river (see figure at left).

**Fulcher Dam and Gate Project:**
The Fulcher Dam and Gate Project is located in northern Lassen County (T39N R7E, Sec. 34). Lateral erosion along the Pit River is degrading a low levee system, Fulcher Dam, and Fulcher Gate that is located on the Krammer Ranch. The dam impounds water that is used to irrigate approximately 1,000 acres when Fulcher Gage is opened. Most of the irrigated acres (approximately 90%) are pasture while the rest is for alfalfa. The pastures are surrounded by grassland and sagebrush vegetation in the western portion of Big Valley. This large expanse of open space provides valuable wildlife habitat for deer, waterfowl, shorebirds, and a variety of other grassland dependent wildlife. The irrigated land is owned by several landowners who have water rights to the water released through Fulcher Gate.

**Mason Ranch**
The Mason ranch is located along the main stem of the Pit River, roughly 5 miles north of Lookout (T40N, R7E, Sec. 35). The floodplain appears to have been excavated in the past. Stream banks are eroding and the downcutting (approximately 10 feet) is moderate to severe (see figure at left). The landowners are interested in stabilizing/re-vegetating the eroding streambanks and improving floodplain habitat. Site visits by restoration practitioners was conducted in 2005. StreamWise recommended that restoration involve extension of the inset floodplain to allow a broader floodplain width and better dissipation of the energy of flood forces. This would also require revegetation of the floodplain and grazing management. The initial estimate was $200,000 for this effort. The Plumas Corporation suggested a conceptual treatment of the use of rock vanes and revegetation, and also lowering the relic floodplain to help spread flood flows and reduce erosion stresses on the channel. These two restoration strategies are similar and would likely result in similar costs.

**DeForrest Ranch Project:**
The DeForrest property lies just west of State Highway 299 north of Adin and encompasses segments of both Dutch Flat Creek and the North Fork of Ash Creek. The property is used primarily for cattle grazing and hay production. The ranch is 509 acres, of which approximately 394 are grassland, sagebrush, and juniper woodland habitat, and the rest consists of pasture.

The proposed DeForrest Ranch Project will address the issue of abandoned floodplains on reaches of Dutch Flat Creek and North Fork Ash Creek that cross the ranch.

Incised channel in the DeForrest Ranch.

**Gould Project**
Low point in floodplain where the river exits the channel into the floodplain.

**Gould Project**
Location where floodplain water re-enters the main channel

These streams were channelized decades ago for agricultural purposes. Downcutting and lateral erosion of the channel began and continues today (see figure at left). This in turn has increased runoff rates and dried what was once a wet meadow.

When completed, the project will re-establish floodplain connectivity on these two stream reaches, raise the local water table, reduce the rate and intensity of runoff from the ranch, and significantly improve aquatic and riparian habitat quality. Species benefiting from habitat improvements include the Redband rainbow trout (California sensitive species), Modoc sucker (Federally listed endangered species), waterfowl, and various Neotropical migrant birds.

Final design criteria are under consideration, but a form of "plug and pond" channel reconfiguration is expected. All design options under consideration include any necessary revegetation work.

**Gould Project**:
The Gould's own and manage approximately 800 acres of land in Big Valley, Modoc County. The Pit River runs through the western portion of their property and is incised between 10 and 15 feet. The Gould's would like to minimize the erosion occurring in their pastures and hay fields. They would also like to improve their irrigation efficiency by installing a pivot system. Currently, the pasture and hay fields by the river are flood and sprinkler irrigated. Roughly 30 acres of pasture is not irrigated, and this acreage is part of an active floodplain that ponds water during high runoff events. Currently, this pasture is for cattle grazing during the spring and summer.

The Gould's would like to stabilize the riverbanks, irrigate the floodplain pasture during the summer, and continue to graze the floodplain pasture during the summer. They are willing to leave more vegetation in the floodplain pasture in the fall and winter in case the river tops the banks and spills into the floodplain.

**Ash Valley Ranch:**
Gary Johns owns roughly 14,000 acres in the upper Ash Valley watershed in Lassen County. The land is the base property for the 20,000 acre BLM managed Ash Valley allotment. The lower reaches of the ranch are within the Ash Valley WUI. Upper reaches of the ranch include declining mule deer, summer antelope and historic greater sage grouse habitat. Over the past five years the ranch has completed over 1,200 acres of juniper treatments. Mr. Johns would like to implement a comprehensive strategy for juniper treatments on his land as well as the adjoining public land in conjunction with BLM.

**Ash Valley Ranch**
Spooner Reservoir and juniper encroachment, most of this juniper is less than 80 years old.

**Ash Valley Ranch**
Young invasive juniper established in the Upper Ash Creek Watershed.

**Butte Creek** area, dark green patches are Jeffery pine, olive green is Western Juniper.
All the juniper in this photo is less than 80 years old.

**McBride Springs**
Heavy fuel loads in the project area

McBride Spring riparian area

**Butte Creek Multi-ownership Land Tracks:**
This project is in the final planning stages and the implementation stage is fully funded through a combination of NRCS Conservation Partnership Initiative/Conservation Innovative Grants, a California Fire Safe Council/BLM Grant and a Lassen County Resource Advisory Committee Grant. The project will treat 300-400 acres of invasive juniper within the WUI, restore critical mule deer habitat and improve the upper reaches of a Pit RCD watershed. It is hoped the private land investment will result in additional treatments on adjoining BLM and US Forest Service Land.

**Lassen County's Tall Whitetop Initiative:**
The Lassen County Board of Supervisors established their Tall Whitetop Committee in the summer of 2006. The collaborative effort's mission is to control and eliminate tall whitetop wherever possible. The Lassen County Agricultural Commissioner estimates that over $12,000,000 is lost annually to Lassen County Agricultural production due to tall whitetop infestations. Small plots have begun to show up within the Pit RCD and it is critical that it is eradicated in the early stages. The committee's goal is to work collaboratively with the California Department of Food and Agriculture and their partners to obtain the millions of dollars necessary to meet its mission. The Pit RCD participates in the effort through its partnership in the Collaborative Sagebrush Steppe Restoration Initiative.

**McBride Springs Fuel Reduction and Stream Restoration:**
The project is located in the upper reaches of Willow Creek on lands owned by Parks Ranch Inc. and US Forest Service lands. Eastside pine stands within the project area show the typical affects of a century of fire suppression including thick pockets of "dog hair" pine and juniper woodland succession. Parks Ranch would like to initiate a comprehensive fuels treatment and stream restoration strategy in conjunction with the Forest Service.

**Rose Creek Juniper Treatment and Stream Restoration:**
The project is located on private and public lands managed by the Lookout Stock Association and US Forest Service. Stream restoration is underway and is fully funded through grants from the California Water Quality Control Board, Modoc County Resource Advisory Committee, the Rocky Mountain Elk Foundation, US Fish and Wildlife Service and other partners. The partners would like to expand the project to include juniper treatments to affect a more comprehensive project.

**South Knob Ranch Juniper Treatments:**
Four thousand acres of the ranch is owned by C.W. Johnson and an additional 2,400 is managed by the BLM. It is situated within the headwaters of Willow Creek. Over the last four years almost three thousand acres of western juniper has been removed and critical mule deer, greater sage grouse and antelope habitat has been restored. Over 260 acres has been set aside as wildlife habitat.

Western Juniper Treatment in the Rose Creek Area

Western Juniper Treatment in the Rose Creek Area

**South Knob**
Year 2000 Stream Restoration Project

The landowner would like to implement additional juniper treatments, aspen grove restoration and expand and improve adaptive grazing management practices.

**Western Juniper Treatment Grass Bank Establishment:**
The size and scope of treating the western juniper problem necessitates the implementation of projects on a large scale. The best restoration projects involve a post treatment rest prescription. The problem arises as to where to place livestock while the land is in its initial recovery stages. As the Cooperative Sagebrush Steppe Restoration Initiative moves forward it will be critical to solve this problem. As a major partner in the initiative the Pit RCD believes it may be in the best position to take the lead. One potential solution is working with the California Department of Fish and Game to explore using a portion of the Ash Creek Wildlife Area for this endeavor. Juniper treatments clearly benefit wildlife by restoring critical habitat. A properly implemented grass bank could also be beneficial to the wildlife area.

**South Knob**
Some of the juniper targeted for treatment