CHAPTER 3: AFFECTED ENVIRONMENT

3.1 GENERAL SETTING

The area covered by this EIS consists of approximately 5.7 million acres of public land, including 4.2 million acres of public land in the northern two-thirds of California and 1.5 million acres of public lands in northwestern Nevada. About 4.4 million acres of these public lands are grazed. The 10.3 million acres of public lands in southern California managed by the California Desert District will not be addressed in this document.

Chapter 3 describes the currently existing physical, biological, social, and economic environment that would be affected by implementing any of the alternatives. Prime and unique farmlands, air quality, hazardous wastes, cultural resources, and areas of critical environmental concern (ACECs) would not be affected by implementing any of the alternatives. However, some resources protected by ACECs would be affected and these are described in this chapter.

3.1.1 Landforms

The coastal province of California is dominated by the Central Valley. This vast sedimentary alluvial plain stretches more than 400 miles north to south, and averages 40 to 50 miles in width. It is bounded on the west by the Coast Range, on the south by the Sierra Madre and Tehachapi Mountains, on the east by the Sierra Nevada, and on the north by the Klamath Mountains, the Cascades, and the Modoc Plateau.

The Central Valley is fed by two major rivers. The Sacramento River, which flows south fed by Mount Shasta's melting snow, is joined by the Pit, McCloud, Feather, Indian, Yuba, and American Rivers which all flow down the western slope of the Sierra Nevada. The San Joaquin River, flowing north, is joined by the Fresno, Merced, Tuolumne, Stanislaus, Calaveras, Mokelumne, and Consumnes Rivers, again all flowing from the Sierra Nevada.

If the Central Valley is the dominant feature of California, the Sierra Nevada is its backbone. This huge granitic range runs about 385 miles north to south and averages 80 miles in width. The range is generally higher in the south and trends lower in the north. There are about 40 peaks over 10,000' elevation, with several topping 14,000'. The eastern slope is very steep, evidence of fault block uplifting; while the western slopes are more gradual, but rugged where the canyons are cut by the large rivers mentioned above.

North of the Central Valley are the Klamath Mountains, the Cascade Range, and the Modoc Plateau. The Cascades are a chain of volcanic cones dominated by Mount Shasta at an elevation of over 14,000'. The Modoc Plateau is an interior draining platform consisting of a thick accumulation of lava flows and tuff beds with many small volcanic cones.

The Coast Range is a series of small mountain chains ranging from 2000 to 7000' elevation, with the higher elevations generally to the north and the lower elevations to the south. These small chains contain numerous small fertile valleys. Many active fault zones, including the San Andreas Fault, occur throughout the length of these ranges. To the north, there are myriad rivers and streams, such as the Klamath, Mad, Eel, and Russian Rivers, flowing west into the ocean. To the south, rivers such as the Salinas, Santa Maria, and Santa Ynez become smaller, and are often intermittent rather than perennial.

East of the Sierra and Cascades is the Great Basin, which extends from California east into Nevada and Utah, and north into SE Oregon, and southern Idaho. This area is typified by north-south trending mountain ranges such as the White Mountains to the east of the Owens Valley. The region is watered in places by perennial or intermittent streams running from the mountains, which form wetlands and marshes or disappear into the dry valley bottoms.

More detailed geologic and topographic information may be obtained from the BLM State Office and Field Offices in the EIS area.

3.1.2 Climate

The climate of the EIS area varies from Mediterranean for most of the area, to steppe in scattered foothill and inland basin areas, to alpine in the high Sierra.

The Pacific Ocean and its maritime air masses have a heavy influence on the climate. The effect of abrupt changes in topography on temperature, wind velocity, and precipitation amount and frequency results in wide variations often within a few miles. The Sierra Nevada and the Cascade Range effectively act as barriers for the movement of continental air masses from the east.

Two of the usual four seasons dominate the EIS area: a dry, warm summer and a cool, wet winter season. Winter lasts from October to April in the north and from November to March in the south.

Winter storms from the west bring precipitation which falls as rain in the valleys and foothills and as snow in the mountains. Precipitation increases from south to north, and falls heaviest on the west side of the mountains. Average annual rainfall is about 11" in Los Angeles, 22" in San Francisco, and 74" in Crescent City. However, the rainfall can vary greatly from year to year, and even within a few miles due to changes in the topography. When the snowpack melts in the spring, the heaviest runoff descends the west side of the mountains. Eastern mountain slopes fall into typical "rain shadows." Locations on the western slope of the Sierra may receive as much as 60" of rain, while the Owens Valley on the eastern side typically receives about 6".

Snow is the major form of precipitation in high, forested, mountainous areas. It can be expected in the Sierra Nevada at any elevation above 2,000 feet during October to May. Above 4,000 feet, snow will remain on the ground for long periods of time, and at even higher elevations will be present all winter.

3.1.3 Hydrology

Hydrology on rangelands in California is quite varied, but can be generalized into three categories based on rainfall: Coastal (tending toward subtropical), Central Valley and foothills (Mediterranean), and East Side or Great Basin (semi-arid). Precipitation through these climatic types is also highly variable. In the rain shadow portion of the Great Basin annual precipitation is as low as 4 to 6 inches; along the north coast it exceeds 100 inches. On the east side of the Sierra, precipitation comes mainly as snow with slow melting and little runoff. In the Central Valley and coast it comes mainly as rain in the winter, often with high intensities and high runoff and flooding. The monsoonal precipitation common in the Sonoran desert of southeast California does not generally occur in the area covered by this EIS.

Hydrology is just as diverse as the climate. The most obvious generality that can be made is that the Great Basin riparian areas are supported by small spring-fed or snow-fed streams, which are mostly intermittent or ephemeral. These streams tend to lose water to the water table as they flow downstream. In contrast, Central Valley and coastal streams are fed by the ground water (the ground water level is generally higher than the stream bed) and gain water down stream. These streams tend to be more persistent than those in the east.

Extensive research has been conducted by universities and research units on the hydrology of California and Great Basin rangelands. More detailed or specific discussions of this subject may be found in these studies. A good introduction to the subject is "Rangeland Hydrology," originally published by the Society for Range Management in 1972, with a second edition published by Kendell/Hunt in 1981 (Branson et al. 1972/1981).

3.2 GRAZING MANAGEMENT and ADMINISTRATION

3.2.1 Allotments and Types of Operation

As previously mentioned, the area covered by this EIS consists of approximately 4.2 million acres of public land in the northern two-thirds of California and 1.5 million acres of public lands in northwestern Nevada. This area is administered by ten BLM Field Offices (previously called Resource Area offices, and sometimes still referred to as such in this document). Currently there are 649 grazing allotments within the area, consisting of 4.4 million acres of public rangeland, producing 338,715 animal unit months (AUMs) of livestock forage (see Table 3.2.1). Traditionally about 90% of this is grazed by cattle and the remainder by sheep.

Note that the number of allotments is different from that used for the Draft EIS. This is mainly due to an oversight in interpreting the records. One office in particular had included within the total number of allotments those which are no longer available for grazing. Most of these allotments consisted of isolated parcels of public land intermingled with privately owned lands, and BLM has disposed of those public lands (through sale or land exchange) or in some cases the allotments were determined to be no longer available for grazing due to some other reason. Some of the other adjustments of allotment numbers reflect land exchanges that have occurred since the preparation of the Draft EIS.

California rangelands are quite unique due to very diverse environmental conditions which require a variety of administrative and management measures for different locations within the state. While BLM administers grazing on perennial vegetation ranges in the Great Basin areas of California and northwestern Nevada (which are typical of most of the public lands in the western states), there is also a substantial amount of grazing on California’s public lands for ephemeral and annual vegetation. Approximately one million acres of public lands within the Mediterranean climate regime contain highly productive grasslands which are composed predominantly of non-native annual grasses and forbs. This type of rangeland is located from the mid-elevations on the western slope of the Sierra Nevada to the Pacific coast throughout the length of California, and is unique in that it is found nowhere else in North America.

Due to this variability in environmental conditions, the types of grazing operations and practices are quite varied throughout the analysis area. In the Great Basin region in NE California and NW Nevada, as well as along the Eastern Sierra escarpment, the majority of allotments consist of relatively large acreages of publicly owned rangelands, sometimes exceeding 100,000 acres. These allotments are mostly grazed during the snow-free season, and the livestock are removed from the allotments and held on privately owned holdings at lower elevations during the winter months. Generally, cow-calf type operations prevail in this region with a few operations using yearling stocker cattle. Historically much more of the region was grazed by sheep than now. However, there are a few sheep operations remaining in the region. Often the sheep are trailed great distances, particularly in the Eastern Sierra region. In some years, sheep operators use ephemeral forage, when available, in the Owens Valley while trailing from ranges in the Mojave Desert to summer ranges at higher elevations.

TABLE 3.2.1: Grazing use within the EIS area

Field Office	# Allotments	# Acres (1000's)	# AUMs
Redding	38	32	3,658
Clear Lake	15	20	1,580
Arcata	11	35	4,122
Eagle Lake	57	990	52,039
Surprise	52	1,454	97,515
Alturas	157	501	56,330
Bishop	60	614	36,931
Folsom	65	69	7,341
Caliente	113	469	56,225
Hollister	81	166	22,974
TOTAL	**649**	**4,350**	**338,715**

Typically the livestock grazing practices and dependency upon the availability of public rangelands in most of the remainder of the analysis area is quite different than in the Great Basin region. This is due to the much different climate and land ownership pattern. Whereas some of the ranges in the Mediterranean and coastal region are grazed all year, the majority of the grazing is limited to the winter and spring months when the annual grasses and forbs are most productive and nutritious. As a rule these publicly owned rangelands are fragmented and mixed with privately owned rangelands, and are only a small portion of the overall grazing for the allotment or ranch. Many of the operations are ranch-based types of operations in which the livestock basically reside within the ranch boundaries at all times and are not as migrant as those in the Great Basin. There is some grazing of sheep on these ranges, but the majority are used by cow-calf and yearling stocker operations.

Almost without exception, there is some amount of grazing on unfenced privately owned rangelands in conjunction with the grazing use on the pubic rangelands throughout the entire analysis area. On over half of the allotments, the amount of privately owned rangelands exceeds the amount of publicly owned rangelands within the area grazed.

3.2.2 Grazing Permits and Leases

Traditionally, grazing use is authorized by the BLM as permits or leases for a period of 10 years. Shorter term permits and leases are sometimes issued for special circumstances, such as to accommodate a shorter term lease of the base property or when the authorized officer determines that a shorter term authorization is in the best interest of range management. Additionally, non-renewable grazing authorizations may be issued for special short-term needs such as trailing, or to allow for grazing use where it has been determined there is short-term surplus forage available for grazing. All permits and leases are subject to modifications and to annual adjustments. These are implemented through consultation between the permittee/lessee and the BLM.

The permits and leases identify the number, kind and/or type of livestock that may graze the allotment, and the grazing period (usually with specific beginning and ending dates). In addition, many permits and leases also require adherence to prescribed grazing prescriptions in the form of grazing systems such as deferred, deferred-rotation, or rest-rotation (see Glossary). Other authorizations may have conditions pertaining to turn-out dates based on soil or vegetation conditions or require (as an example) a post-grazing residual mulch level. Some permits/leases also have specific grazing utilization standards and other specified conditions to protect site specific areas, such as riparian areas, deer fawning habitat, special status plant populations, etc. Usually these conditions have been developed in consultation and cooperation between BLM and the livestock operator in the form of an allotment management plan or other planning effort.

Often there are occasions when the permittee or lessee elects to graze less than the full amount of grazing authorized for the grazing season. Sometimes this is due to environmentally-related factors such as droughts or fires and in other cases it may be to accommodate the livestock operator’s needs to adjust livestock numbers for marketing or livestock husbandry purposes. Normally the BLM will authorize the requested amount of non-use on a short-term basis for the above reasons. In some situations the BLM may temporarily authorize another qualified applicant to graze the amount of authorized non-use in an allotment, but this is seldom done.

3.2.3 Range Improvements

In order to facilitate more effective and economical grazing use, structural facilities, commonly called range improvements, are installed on the allotments. Some of these improvements, such as corrals and other exclosures, are needed to facilitate the handling of livestock; others, such as wells and spring developments, are to provide water for the livestock and wildlife. Other improvements, such as fences or strategically located watering or salting facilities, are more related to controlling the livestock for effective grazing management, by re-distributing the grazing activities throughout the allotment (although they may improve wildlife habitat too). Traditionally these types of facilities have been installed as cooperative ventures between the permittee/lessee and the BLM. Many of these types of improvements have been installed and maintained exclusively by the rancher as permitted by BLM. Many facilities are also located on privately-owned or non-Federal lands within allotment boundaries. In the past, there have been re-vegetation or vegetation conversion projects on some allotments or parts of allotments. Examples include re-seeding projects using either exotic or native species, and brush control projects using either mechanical or chemical methods or prescribed fire. There has been mixed success with all of these projects in meeting expectations.

3.2.4 Grazing Systems

Most prescribed grazing systems are designed cooperatively between the permittee/lessee and the BLM to meet both the needs of the rancher and to protect or enhance some non-livestock related rangeland resources. Often there is some compromise by both parties in order to achieve objectives. Some of the grazing systems are quite intensive, requiring frequent monitoring and oversight by both the livestock operator and the BLM. These systems may include scheduling of livestock movement dates between pastures and established grazing utilization thresholds either in the form of percent of forage removed or grazing stubble height requirements. Other systems may require that a certain amount of forage growth be evident prior to any grazing and/or that a specified amount of residual vegetation be left after the grazing period. This latter condition is common for the allotments in the California annual grasslands.

As a rule, most of the allotments with a substantial amount of public rangeland have a BLM prescribed intensive grazing system. These allotments constitute most of the public land acres grazed. On the other hand, on allotments containing small amounts of public land, particularly those which also contain a majority of privately owned or controlled lands, the grazing systems used are more at the discretion of the livestock operator. However, in all situations, the permittee/lessee is responsible to adhere to all of the terms and conditions identified within the grazing authorization, and BLM is responsible for conformance oversight and the monitoring of resource conditions.

BLM sets priorities for which allotments require intensive grazing management to meet public rangeland resource needs, realizing that capabilities are limited to fully prescribe and monitor intensive grazing management on all allotments. Appendix 5 identifies the current allotment management prioritization in the EIS area. Most of the allotments identified for "I" (intensive or improvement needed) management, as well as many of the "M" (moderate or maintain) allotments, have prescribed grazing systems.

Managing livestock grazing to meet both the economic needs of the permittee/lessee and to meet the needs of all rangeland resources is very challenging in many situations. Many of the allotments, for example, contain relatively small areas of riparian and wetland habitats, fragmented throughout the allotment. Because livestock are attracted to these areas for their succulent forage, shade and water, it is extremely difficult to sustain the resource values of these areas without intensive herding of the animals or installing fences or other barriers (Kie and Boroski 1996). The amount of forage, although quite lush, that these areas provide in comparison to the total for the allotment is often quite small (bordering on minuscule). Grazing systems involving changing the timing or level of grazing use on these areas have had mixed success, and managing these areas continues to be perplexing.

Another recent challenge for both the livestock operators and the BLM involves protecting populations of threatened and endangered plant and animal species habitat. As an example, some of the grazing allotments in the San Joaquin Valley managed by the Caliente and Hollister Field Offices contain scattered populations of threatened or endangered plant species. Much is not yet known about the influence grazing may have on these species. Efforts have been made to exclude some of these populations from grazing by installing fences or having the livestock operator agree to not graze a specific area during an assumed critical time of the year. However, most of these plants are annuals and the locations and magnitude of the populations often vary greatly between growing seasons. Providing ample protection for these species remains challenging, particularly in areas where the public rangelands are intermingled with comparatively larger amounts of non-Federally owned land.

Another common issue related to livestock grazing on several allotments relates to competition between domestic livestock grazing activities and other ungulates for forage and habitat. This is particularly true regarding dietary overlap between domestic livestock, wild horses and burros, and mule deer in the Great Basin ecoregion. There remains considerable dispute about what levels of grazing use for livestock can be sustained and what levels of use and population numbers are appropriate for competing ungulate species.

3.2.5 Monitoring

Monitoring can be defined as the orderly, repeated collection and analysis of resource data to evaluate progress in meeting resource management objectives (this is based on BLM Manual 6600). The repetition of measurements over time for the purpose of detecting change distinguishes monitoring from inventory.

Types of monitoring.

Several types of monitoring have been identified. The following two are particularly relevant to monitoring livestock grazing (see MacDonald, et al. 1991, for a discussion of these and other types of monitoring).

1. **Trend monitoring**. Monitoring to determine the long term trend in a particular parameter. For example, is the population of a key species increasing, decreasing, or remaining stable at a particular site?

2. **Implementation or compliance monitoring**. This type of monitoring assesses whether activities were carried out as planned or whether livestock operators are complying with the terms of management plans and permits/leases. For example, did BLM construct the pasture fence in FY 1993 as called for in the activity plan? Did the operator move the mineral blocks at least 1 mile from the riparian-wetland areas as required in the allotment management plan? One of the major types of rangeland monitoring, involving the measurement of utilization (or the reverse of utilization--residue) is a form of compliance monitoring. We'll discuss this in detail below.

Levels of monitoring.

Qualitative and semi-quantitative monitoring. Although many people equate monitoring with the gathering of some type of quantitative information, qualitative assessment of the condition of rangeland resources is a valid and important form of monitoring. Because of constraints related to limited budgets and workforces and the number of allotments for which BLM is responsible, qualitative monitoring is the level of monitoring most commonly employed in grazing management. Following are types of qualitative and semi-quantitative monitoring:

1. **Stewardship integrity monitoring**. This involves visiting areas to ensure the habitat has not changed dramatically, as might occur with fire, overgrazing, trespass mining, vehicular use, etc. Aerial photography at specified intervals could also be used to assess some of these impacts without actually visiting the site.

2. **Photoplots**. Photographs can provide important documentation of changes, particularly to habitat, over time. Although listed here under qualitative techniques, photoplots can also be used as a form of quantitative measurement. For example, several close-up photographs may be taken at a site and the number of individuals of the plant species of interest in each photograph counted or estimated.

3. **Presence or absence**. Sites are visited to determine if a rare species is still extant or to determine whether a noxious weed has invaded a site.

4. **Occurrence mapping**. An occurrence of a rare species or a riparian area may be mapped by delineating the distributional boundaries on the ground or on aerial photos.

5. **Ocular estimates of density**. Sites are visited and estimates of abundance made of rare or key plant species. The plant species is ranked as to abundance class (e.g., not present, 1-10 plants; 11-100; 101-1000; 1001-10,000; etc.).

6. **Utilization pattern mapping**. Mapping the utilization made on key forage species is an important and effective form of grazing monitoring. The entire allotment or individual pasture is canvassed, usually following the removal of livestock, and the amount of utilization in different areas on one or more key plant species is assessed. Areas are then mapped into several classes based on level of utilization (e.g., no use, light use, moderate use, and heavy use). Ocular estimation is often used to assign areas to one of these classes, but sometimes quantitative studies are also used (e.g., utilization transects are established in different areas of the allotment and used to assign these areas to a particular utilization class).

   Utilization mapping is usually done each year for several years to determine if patterns are consistent from year to year. Where rest rotation grazing systems are in place, yearly mapping is normally conducted until the completion of at least one rotational cycle. The results of utilization pattern mapping can then be used to identify over-utilized areas of the allotment in need of adjustment through different management and to locate key areas (discussed below) for future monitoring studies.

7. **Other observations**. Additional information deemed to be important may be collected based on ocular estimates. Examples are: presence/absence of individuals of a key species in different size classes; rough categorical estimate of the percent of plants in each size class; presence/absence of a defined condition in individuals at a given location (e.g., flowering, diseased, infested by insects, dead); rough categorical estimate of the percent of plants exhibiting the condition (e.g., 25-50% flowering).

The strengths of qualitative and semi-quantitative monitoring are that it is quick and therefore inexpensive, it allows assessment of large areas, such as complete allotments and pastures, it provides insight on condition and management needs, and it can serve as a "red flag" to trigger quantitative monitoring. The weaknesses of this type of monitoring are that different observers may reach different conclusions when no real difference exists; the interpretation is somewhat subjective; it provides purely descriptive information with no potential for analysis; and the only detectable change is often dramatic and severe.

Quantitative monitoring. In performing quantitative monitoring studies you *measure* something. This can mean, for example, that you count the number of individuals of a key plant species (either in total or by size class), you estimate its cover in plots, or you measure the size (height, cover or both) of individual plants. Quantitative monitoring involves taking a sample to estimate something about the parameter of interest, such as the cover or vigor of a key species in a pasture. Because sampling is involved, there is error around estimates of these parameters that must be considered in analysis. Statistical analysis takes these sampling errors into account when determining whether changes have occurred or thresholds (such as utilization levels) have been crossed.

Key area concept. Many, if not most, rangeland vegetation monitoring studies employ the key area concept. Using this approach, key areas are selected (subjectively) that (we hope) reflect what is happening on a larger area. Key areas are areas chosen to be representative of a larger area (such as a pasture) or critical areas such as riparian-wetland areas and sites where endangered species occur. Monitoring studies are then located in these key areas.

Although we would like to make inferences from our sampling of key areas to the larger areas they are chosen to represent, there is no way this can be done in the statistical sense because the key areas have been chosen subjectively. An alternative is to sample the larger areas, but the constraints of time and money coupled with the tremendous variability usually encountered when sampling very large areas often makes this impossible. The key area concept represents a compromise.

Because statistical inferences can be made only to the key areas that are actually sampled, it is important to develop objectives that are specific to these key areas. It is equally important to make it clear that actions will be taken based on what happens in the key area, even when it can't be demonstrated statistically that what is happening in the key area is happening in the area it was chosen to represent. It is also important to base objectives and management actions on each key area separately. *Values from different key areas should never be averaged*.

Key species concept. Just as the key area concept is a compromise between sampling an entire allotment versus sampling only a portion of it, the key species concept is a compromise between tracking change in all plant species versus tracking change in those species that are most likely to be affected by management. The latter species are called key species and are chosen based on several criteria. First, they are usually species that are preferred forage for livestock. Thus, they can be expected to increase under proper grazing management and decrease under improper grazing management. They therefore provide valuable information on the success of management. Second, they should be common enough that monitoring them will not be overly difficult or intensive. Third, changes in the distribution, vigor, or abundance of these key species should be representative of similar changes to other species deemed to be important to the plant community desired for a particular site. In this instance key species serve as keystone or indicator species. A fourth criteria that can be employed is legal status: special status plants may be singled out to be monitored regardless of their rarity or whether they function as keystone or indicator species.

Long-term (trend) monitoring. What most interests the range manager is how ecosystems (including plant and animal communities and abiotic factors such as soil) change over time in response to management. Usually only vegetation is monitored and an assumption made that if certain types and amounts of desired vegetation are present then the desired animals and desired soil conditions are also present. The assessment is made through either quantitative or qualitative monitoring studies usually located in key areas of the allotment. Photoplots and checklists are the principal qualitative monitoring method used in trend monitoring. An example of the checklist approach is the proper functioning condition checklist used in riparian areas. Although this approach can be considered to be inventory, its use at the same site on two or more occasions is a form of monitoring.

Quantitative monitoring methods are several and usually entail the measurement of some attribute of key species at key areas. The Interagency Technical Reference, Sampling Vegetation Attributes (BLM et al. 1996a), includes most of the types of range studies employed by BLM nationwide. In the EIS area the two most common quantitative trend methods involve the use of cover and frequency measurements.

Cover measurements entail the estimation of the percentage of ground surface covered by vegetation. Three types of cover are measured, depending on the measurement method and the biology of the target plant(s). *Canopy cover* is the area of ground covered by the vertical projection of the outermost spread of the foliage of plants, including any small openings in the canopy. Canopy cover measurements are used in estimating the cover of shrubs, trees, and herbaceous plants. The line intercept method (BLM et al. 1996a) is most often used to estimate shrub and tree cover or, alternatively, aerial photographs are used. Canopy cover of herbaceous plants is usually made using plots, such as those described for the Daubenmire method (BLM et al. 1996a). *Foliar cover* is the area of ground covered by the vertical projection of the aerial portions of plants, with small openings in the canopy excluded. This is the type of cover measured by the point intercept method (BLM et al. 1996a), a method used primarily for herbaceous plants. *Basal cover* is the area of ground surface occupied by the basal portion of plants. This is the type of cover often used to monitor changes in bunchgrasses or tree stems. The basal area of bunchgrasses is estimated using line intercepts or estimation in plots. Several methods are applicable to the estimation of tree basal cover; these, however, are rarely used in grazing-related monitoring and will therefore not be discussed here.

Depending on objectives, cover is measured on key species, on all species, or on broad cover categories (e.g., live vegetation, litter, bare ground, and gravel). Total ground cover is important in determining whether sites are adequately protected from accelerated wind and water erosion. Cover of key species is important in determining whether objectives relative to increasing or maintaining the key species are being met.

Changes in the canopy and foliar cover of herbaceous species can be difficult to interpret because they can vary widely with climatic fluctuations. It is therefore difficult to tell whether changes are due to grazing management, weather, or a combination of both. Basal cover is much less sensitive to climatic fluctuations and a better indicator of trend in those species that are amenable to basal cover measurement (e.g., perennial bunchgrasses). The canopy and foliar cover of most woody shrubs does not vary nearly as much as herbaceous plants with climatic fluctuations, and these types of cover are often used to assess trend due to management (sub-shrubs, however, can present the same interpretation problems as herbaceous plants).

Frequency is another attribute often used to assess long-term trend on rangelands. It is one of the easiest and fastest methods available for monitoring vegetation. Frequency is the number of plots (called quadrats) occupied by a particular species, expressed as a percentage. For example, let's say we decide to sample 100 randomly placed 1m x 1m quadrats in a key area. If 40 of these have Key Species A in them, then we say that the frequency of Key Species A in that key area is 40 percent (note that we are interested only whether the species is present or absent in each quadrat--a species is present in a quadrat if 1 or if 100 plants occur in it). We then compare this 40 percent frequency with the value we come up with the next time the key area is sampled to determine if the trend in this key species is up, down, or static. The best results are obtained when frequencies range from 20-80 percent.

Unlike cover, which is not dependent on the type or size of sampling unit used, frequency is only meaningful when the same quadrat size and shape is used in each year of measurement. When measuring the frequency of more than one plant species, it is often difficult to use the same size quadrat and maintain a frequency of 20-80 percent for all species. In these situations a nested frequency quadrat is often used. For example, within a 1m x 1m quadrat, three other quadrat sizes, 50cm x 50cm, 30cm x 30cm, and 10cm x 10cm, are nested. At each random placement of the quadrat, the smallest to the largest quadrat size is searched for the target species. If the species is found in the smallest quadrat, then it is also found in all other quadrats; if it is not found in the smallest quadrat, then the next smallest quadrat is searched, and so on. Once the first year's data are collected, optimal quadrat sizes can be determined for each species.

Changes in frequency can be due to changes in density or spatial pattern. Interpretation can be difficult because of this. However, if the data are recorded on a quadrat-by-quadrat basis, if seedlings and established plants are recorded separately, and if other trend data such as cover are collected at the same time, interpretation becomes easier.

The vertical structure of vegetation can be extremely important to wildlife. This is especially true in riparian areas. Most offices monitor this through the use of photoplots and other qualitative methods. Some offices use quantitative techniques such as the cover board method (BLM et al. 1996a) to monitor vertical structure.

Short-term (utilization) monitoring. Except for very favorable sites, such as riparian-wetland areas, changes in vegetation attributes such as frequency and cover can be very slow, making it hard to detect these changes until many years or even decades have passed. This lag time not only makes it difficult to assess the effects of management, it can place the natural resources at risk: if the changes, once they are detected, are in the wrong direction, correcting this downward trend may be all that more difficult or even impossible. Supplementing long-term monitoring with short-term monitoring studies is a means of reducing this risk. These short-term studies either monitor the amount of utilization made on key plant species or they monitor the amount of plant material remaining after grazing (the latter is referred to as residue).

Management objectives are developed that specify how much utilization is allowed on key species or, alternatively, the minimum amount of residue allowed before livestock are moved off a pasture. Utilization or residue is then estimated through monitoring studies, and management actions implemented accordingly. These management actions can consist of taking immediate action in the same year (i.e., immediately moving livestock out of the pasture once the utilization or residue threshold is approached or crossed) and of making long-term changes to the livestock grazing on an allotment (i.e., reducing stocking rate or season of use if utilization levels are consistently high or residue levels consistently low).

Several methods are used by different field offices in California to estimate utilization. The Interagency Technical Reference, Utilization Studies and Residual Measurements (BLM et al. 1996b), describes these methods.

There are at least two implicit assumptions made when setting management objectives based on utilization and residue. One relates to the vigor of the key species considered to be important to maintaining or improving sites. The assumption is that if these key species are grazed appropriately they will improve in vigor, which will result both in increased production of existing plants and increased recruitment of additional plants. The other assumption relates to the protection of soil: if enough of the vegetation is left after grazing, the soil will be adequately protected from accelerated erosion. These assumptions, while reasonable, need to be reinforced through long-term monitoring. The *levels* of utilization or residue also need to be tested through long-term monitoring (e.g., is 40 percent utilization too high or 500 pounds of residue per acre too low to ensure good plant vigor or good soil protection?).

Most current BLM land use plans allow for utilization of key perennial grass species of 50 percent of the annual above-ground production (some plans specify a range of 40-60 percent utilization). Holechek (1991), however, points out that:

> A 50% use level works well in the flat, humid regions of the Great Plains and Southeast because of their high productivity and high adaptability of the plants to grazing. However in most cases it causes range destruction in the rugged, arid ranges of the West. Research shows stocking rates that involve a 30 to 40% forage use level will enhance range recovery, maintain adequate food and cover for wildlife, protect soil resources and will give the highest long term economic returns with the least risk on nearly all of the western range types (see reviews by Holechek et al. 1989, Vallentine 1990).

The recommendations of Holechek et al. (1989 and 1995) and Holechek (1991) are given in Table 3.2.5, along with the sources behind these recommendations.

On annual grasslands, minimum levels of residue are set. Because these communities are dominated by annual species, the residue dries out during the summer (even the above-ground portions of most of the native perennial species, such as the several members of the lily family often present, dry out during this period). The goal is to maintain a certain level of residue, usually called residual dry matter (RDM), until the first fall rains (see the section on Major Vegetation Types for more information on why these RDM levels are important). Short-term monitoring consists of estimating the amount of RDM (in pounds per acre or kilograms per hectare) remaining in key areas during the period when livestock are present. When RDM levels become close or cross the prescribed threshold, livestock are removed from the allotment. Most offices use the comparative yield method (BLM et al. 1996b) to estimate RDM levels, but reference photographs showing the different RDM levels are also used for this purpose.

Table 3.2.5: Utilization guidelines for different range types in the EIS area (adapted from Holechek et al. 1995 and Holechek 1991).				
Average Annual Precipitation		Percent Use of Key Species for Moderate Grazing [1]	Range Types	References
cm.	in.			
13-30	4-8	25-35	Salt desert shrubland	Hutchings and Stewart (1953)
13-30	8-12	30-40	Semidesert grass and shrubland	Valentine (1970) Martin and Cable (1974)
13-30	8-12	30-40	Sagebrush grassland	Pechanec and Stewart (1949) Laycock and Conrad (1981)
25-100	10-40	50-60	California annual grassland	Hooper and Heady (1970) Bartolome et al. (1980) Rosiere (1987)
40-130	16-50	30-40	Coniferous forest	Pickford and Reid (1948) Johnson (1953) Skovlin et al. (1976)
40-130	16-50	30-40	Mountain shrubland	Pickford and Reid (1948) Skovlin et al. (1976)
40-130	16-50	30-40	Oak woodland	Brown (1982) [2]
25-45	10-18	30-40	Pinyon-juniper woodland	
16-50	20-30	20-30	Alpine tundra	Thilenius (1979)

1 Ranges in good condition and/or grazed during the dormant season can withstand the higher utilization level. Those in poor condition or grazed during active growth should receive the lower utilization level.

2 These guidelines apply to oak woodlands with a perennial grass understory.

Residue is also used to set grazing management objectives for the herbaceous vegetation in riparian-wetland areas. Most of these plants are perennials that remain green throughout the summer. Consequently, objectives normally set minimum stubble height levels instead of production levels. These stubble heights may be set for key species only or for all graminoid plants (grass-like plants, including grasses, sedges, and rushes). Monitoring then consists of estimating the stubble heights at key areas through sampling, and moving livestock from the pasture or making other management changes when minimum thresholds are approached or crossed. See BLM et al. (1996b) for the method used to estimate stubble heights. Qualitative methods such as photographs are also used.

It is also important to estimate utilization on shrubs, where these species are important components of the ecosystem. Areas that support shrub species that are used by livestock and wildlife include: (1) riparian areas, which often support willows and other shrubs; (2) areas within the sagebrush steppe where bitterbrush and other shrubs are important components; and (3) areas where saltbushes and other related shrubs occur, both in the sagebrush steppe and annual grassland vegetation types. There are three primary methods used to monitor shrub utilization: (1) the twig length measurement method, (2) the Cole browse method, and (3) the extensive browse method. These are described in BLM et al. (1996b).

Analysis, interpretation, and evaluation. Data collected as part of quantitative studies must be analyzed using appropriate statistical methods. Confidence intervals must be constructed around estimates of utilization levels and significance tests applied to trend data to determine if observed changes are significant. The results of this analysis must then be interpreted and evaluated. Recent reviews of monitoring activities conducted by the BLM California State Office have revealed that while much effort has been expended in collecting monitoring data, too little effort has been directed toward analysis, interpretation, and evaluation. In addition, many field offices do not have personnel with the necessary expertise to analyze monitoring data and design monitoring studies that have the power to detect changes that are biologically significant. As a consequence, very few allotment evaluations have been conducted over the past few years, and few management changes have been implemented as a result of monitoring. Steps are being taken to correct this problem, but much remains to be done.

Existing situation. Monitoring and existing data indicate that 387 (60%) of the 649 grazing allotments in the project area meet the fundamentals of rangeland health or are making significant progress toward meeting the standards with current management practices.

59 Allotments were identified as being in Category 1 -- areas where one or more standards are not being met, or significant progress is not being made toward meeting the standard(s), and livestock grazing is a significant contributor to the problem. Some form of livestock management change will be made in those allotments, based upon site-specific needs. In most cases, it is only a small acreage in an allotment that fails to meet the fundamentals.

190 allotments are in Category 3 -- areas where the status for one or more standards is not known, or the cause of the failure to meet the standard(s) is not known. These will be reviewed on a priority basis, as described in Appendix 21.

There were an additional 13 allotments in Category 4 -- areas where one or more standards are not being met due to some other resource use or problem than grazing. As priorities and funding allow, the authorized officers will take appropriate action based on regulation or policy to correct these situations.

Appendix 21 contains a detailed listing of these allotments.

3.3 UPLANDS

3.3.1 Soils

Soil characteristics vary considerably throughout the affected area. Soils which support livestock grazing are six inches to over sixty inches deep; and the soil textures include nearly every category defined, ranging from coarse textured "loamy sand" soils to fine textured "clay" soils. Similarly, other soil properties which influence vegetation and watershed function, such as permeability, infiltration, fertility, structure, and organic matter content, vary throughout the broad geographic area.

The soil characteristics at any specific site are the result of a number of factors which influence soil formation rates and site stability. Jenny (1980) expressed a relationship for the ecosystem in which the soil is a function of climate, time, parent material, relief, vegetation, and organisms. The soil properties expressed are either in equilibrium with the factors and the ecosystem or changing in response to changes within the ecosystem. Human intervention that modifies any of the factors, vegetation for instance, can have a dramatic effect on this equilibrium.

Most of the affected areas have modern soil surveys which describe the soil characteristics and geographic extent of the various soil types. These soil surveys contain the base line data necessary to define "properly functioning condition" of the soil resource.

The interactions between the physical, chemical, and biological properties of soils and plants strongly influence soil stability and watershed function. Livestock grazing activities can directly affect this interaction and watershed health. Hoof action on soils with optimum moisture content can modify soil structure and compact soil layers. Compacted soil reduces root penetration, seedling germination, water infiltration rates, and biological activity, limiting the soil volume available for moisture retention and plant support, and increasing runoff rates. The results can be changes in the plant species composition, reduction of vegetative biomass production, and increased hillslope and streambank erosion.

Plant litter plays an important role in soil stability, energy flow, and watershed function. Removal of vegetation by livestock grazing can reduce litter production and accumulation. Litter provides surface cover which protects the soil from erosion and contributes organic carbon and nutrients to the soil. Organic carbon is at the base of the soil microorganism food chain. Soil microorganisms release nitrogen, phosphorus and other plant nutrients, and build soil structure and porosity. Seventy percent of ecosystem biodiversity occurs below the soil surface.

Both historic livestock management practices and fire suppression activities have modified plant community composition, often resulting in reduced soil cover and increased bare soil surface area. Increased erosion rates and water runoff rates may occur as a result of this change in equilibrium. The changes will likely continue until another equilibria state or balance is achieved.

The current condition of the soil resources is displayed in Table 3.3.1 - Soil Resource Condition Status. This information was developed at the field level by individual Field Office staff, those individuals with the most current knowledge of local resource conditions and trends. The soil condition standards used for this comparison are those described for each alternative proposed in this document. They include:

1. Soils exhibit functional biological, chemical and physical characteristics that are appropriate to soil type, climate, desired plant community, and land form.

2. Precipitation is able to enter the soil surface and move through the soil profile at appropriate rates. There are little or no development of physical soil crusts/surface sealing, or compaction layers below the soil surface.

3. The soil is adequately protected against accelerated erosion, with sufficient ground cover (plants, rock, gravel, etc.) and sufficient litter/residual dry matter. There is

minimal evidence of accelerated erosion in the form of rills, gullies, pedestalling of plants or rocks, or deposition of alluvial or aeolian material. Any such evidence does not exceed the natural rates for the site.

4. The soil fertility is maintained at appropriate levels, as shown by a diversity of plant species (and age classes in perennial areas), with a variety of root depths, is present, plants are vigorous during the growing season, and they represent the desired plant community.

5. Biological soil crusts are intact, and in place, where appropriate.

Table 3.3.1: Soil Resource Condition Status Within Grazing Allotments*

Acres (1000's) which **meet** soil condition standards	Acres (1000's) which **do not meet** soil condition standards	Acres (1000's) with Insufficient Knowledge to Determine
4,168	120	112

* (This data was developed by Field Office staff based upon major known problems. More site specific information will be known as we actually complete inventories of areas using the Rangeland Health standards.)

Those areas where soil conditions fail to meet the standards described in the alternatives are functioning below the thresholds suggested for proper watershed function.

Many Field Offices have areas that are dominated by noxious weeds such as yellow star thistle, medusahead and tarweed. A significant factor in watershed function resulting from this condition is the potential loss of root mass and root depth associated with healthy perennial grasses. This root distribution and mass contributes to fertility, organic matter, water intake, aggregate stability, and erosion reduction. A loss of perennials and replacement with annuals results in less root mass and reduced rooting depth, and may contribute to greater runoff, compaction, increased erosion, and loss of fertility and site capability.

Several allotments in northeastern California are dominated by the noxious weed medusahead and lack a significant component of perennial grasses. This condition is mostly associated with soils that have a heavy clay texture that expands and contracts with changing moisture content. This physical phenomenon creates poor seedling establishment conditions, making native plant recovery difficult and slow. As a result of the greater flammability of the medusahead over perennial vegetation, frequent fires have reduced the shrub component, further altering the vegetative diversity. The trend in condition in these areas is currently static, and is unlikely to be changed by changing grazing management. Other reasons for failure to meet soil standards are recent fire disturbance, improper grazing management, and poor road maintenance by county road crews.

3.3.2 Vegetation

Major Vegetation Types

Livestock grazing occurs in a variety of natural vegetation types within the three major Floristic Provinces recognized by Hickman (1993): 1) the California Floristic Province, 2) the Great Basin Floristic Province, and 3) the Desert Province. This EIS evaluates grazing management in the California and Great Basin Floristic Provinces (see Map 4). Grazing on BLM lands within these two provinces occurs mostly on annual grasslands in the coastal, Great Valley, and Sierran and Cascade foothill regions, and in the sagebrush steppe vegetation of the eastern Sierra Nevada, Modoc Plateau, and intermountain regions. Grazing occurs in riparian and wetland vegetation in both of these provinces.

Many different systems have been devised to classify the vegetation of California. The most recent of these is one by Sawyer and Keeler-Wolf (1995), which classifies vegetation to the level of *series*. Series are defined based on the dominant overstory species. Sawyer and Keeler-Wolf describe more than 250 series for California, and additionally describe other habitat types such as vernal pools. A classification system to be used in conjunction with the California Wildlife-Habitat Relationships (WHR) System is presented in Mayer and Laudenslayer (1988). That treatment recognizes about 50 habitat types, based mostly on vegetation, for the State. Many other systems have been proposed and used to varying degrees. These include those developed by Holland (1986), Keeley (1990), Parker and Matyas (1979), Barry (1989), Munz and Keck (1959), Cheatham and Haller (1975), and Küchler (1977), among others. A useful crosswalk to those classification systems developed before 1988 can be found in de Becker and Sweet (1988).

This document addresses only those California vegetation types found on rangelands [1] managed by the BLM that are under permit or lease for grazing by domestic livestock. For analysis purposes we combine the 14 WHR habitat descriptions found in Mayer and Laudenslayer (1988) that apply to these lands into three major vegetation types: 1) annual grasslands, 2) sagebrush steppe, and 3) wetland-riparian. Table 3.3.2(a) (page 3-31) shows how these major types relate to the 14 WHR types. The table also lists the most representative and widespread vegetation series of Sawyer and Keeler-Wolf (1995) found within each of the three major types. We address annual grasslands and sagebrush steppe below; wetland-riparian vegetation is covered in Section 3.4.2.

From the end of the Pleistocene, some 10,000 to 12,000 years ago, until the introduction of cattle and sheep to California beginning in the 1700s, the grassland ecosystems of the State were devoid of large, ungulate grazers. The native large herbivores, pronghorn antelope, mule deer, and three elk taxa (Roosevelt, tule, and Rocky Mountain elk), are facultative browser/grazers or browsers, and not grazing specialists like cattle (Painter 1995; Vallentine 1990). The types of grazing pressure exerted by these native animals is therefore much different than that applied by domestic livestock.

Some authors (e.g., Edwards 1992; Burkhardt 1996) have pointed out that the herbaceous plant species extant today evolved long before the end of the Pleistocene and, therefore, must have developed resistance to the grazing of the large, now extinct, herbivores present at that time. Others, however (e.g., Baker 1992; Painter 1992), point out that 10,000-12,000 years is more than enough time for these plant species to have lost whatever resistance to grazing they may have possessed. The renewal buds of bunchgrasses (which were the primary type of grass present in upland grassland communities of California) are exposed at or above soil

[1] Rangelands are lands on which the native vegetation (climax or potential) is predominantly grasses, grass-like plants, forbs, or shrubs (SRM 1989).

level where they are not protected from close grazing (Baker 1992). This contrasts with the rhizomatous and stoloniferous grasses common to the Great Plains; these grasses are well adapted to grazing, and their renewal buds can escape even sheep grazing (Baker 1992). In addition, Baker (1992) questions whether any large herbivore in California during the Pleistocene was really a grazer similar to the modern day bison (which did not occur in California; Painter 1995; McDonald 1981). Certainly the lack of resistance to livestock grazing of one of the dominant, presettlement perennial bunchgrasses of the sagebrush steppe, bluebunch wheatgrass (*Pseudoregneria spicata* ssp. *spicata*), is well documented (Mack and Thompson 1982; Anderson 1991).

Despite the degree of resistance to grazing of the native perennial bunchgrasses of California, there is no denying that the annual grasses now naturalized in the California annual grassland vegetation type are well-adapted to grazing by domestic livestock. Thus, in a sense, the "rules have changed" in that vegetation type. Several authors have pointed to benefits to native forbs and native bunchgrasses from properly timed grazing of annual grasses (e.g., Heady 1956, Barrett 1992, Blumler 1992, Edwards 1992, Stebbins 1992), but there is certainly disagreement on this issue (e.g., Belksky 1992; summary in Painter 1995). Ongoing research in the Carrizo Plain by BLM, The Nature Conservancy, and the California Department of Fish and Game seeks to provide an answer to the question of whether livestock can be used as a tool to encourage the expansion of native forbs and perennial grasses into areas now dominated by introduced, naturalized grasses.

Annual Grasslands.

This major vegetation type occurs entirely within the California Floristic Province (Map 4), an area often also referred to as "cismontane California," described by Munz (1979) as those parts of the State lying between the crest of the Cascade-Sierra axis and the coast. [2] Herbaceous vegetation, usually dominated by annual grass species, is the feature common to this type. These grasslands often occur as treeless expanses in and on both sides of the Central Valley, as well as on ridges and south-facing slopes of the outer Coast Ranges. In the foothills of the Sierra Nevada, Cascade, and Coast Ranges, these grasses also occur as an understory to various tree species, most notably blue oak (*Quercus douglasii*), valley oak (*Q. lobata*), interior live oak (*Q. wislizenii*), and foothill pine (*Pinus sabiniana*). Near the coast, the grasses can form an understory under coast live oak (*Quercus agrifolia*) and other tree species. In the southern San Joaquin Valley these grasslands also occur as understory to shrubs, principally allscale (*Atriplex polycarpa*). Annual grasses can also occur within areas dominated by chaparral and coastal scrub habitats, but usually only for brief periods of time following disturbance, such as fire or mechanical manipulation for range improvement (BLM does not mechanically manipulate chaparral and coastal shrub for range improvement purposes, but other landowners do). Because of the limited extent of livestock grazing within chaparral and coastal sage scrub, those communities are not addressed further here.

Native perennial grasses formerly dominated most of the area currently occupied by annual grass species. Purple needlegrass (*Nasella pulchra*) is considered by Heady (1977) to have been the dominant species in most of these grasslands (except near the coast), with many other perennial species occurring as associates, including nodding needlegrass (*N. cernua*),

---

[2] Cismontane also refers to the area of southern California between the coast and the crest of the several ranges that form the divide between desert and coastal drainages. This area of cismontane California, however, is outside the region covered by this EIS.

one-sided bluegrass (*Poa secunda* ssp. *secunda*), California fescue (*Festuca californica*), blue wildrye (*Elymus glaucus*), junegrass (*Koeleria macrantha*), and California melic (*Melica californica*). Native annual grasses also occurred, probably in areas disturbed by fire or other forces (Heady 1977). These included annual fescue (*Vulpia microstachys*) and old-field three-awn (*Aristida oligantha*). Near the coast, different perennial grass species dominated, particularly California oatgrass (*Danthonia californica*) and Idaho fescue (*Festuca idahoensis*).

These perennial grasses have been replaced throughout most of their former range by annual grass species native to the Mediterranean region. Burcham (1957) well documents this replacement of the pristine grassland, and Heady (1977) summarizes it. The replacement appears to be the result of complex interactions beginning in the mid-1800's between 1) the invasion by alien plant species; 2) the introduction of domestic livestock, resulting in changes in timing and pattern of grazing; 3) drought; 4) cultivation, and 5) fire (Heady 1977; Burcham 1957). The result was that, by the end of the 19th Century, the nature of the once perennial grasslands had been completely changed.

Stromberg and Griffin (1996) suggest, based on studies at the Hastings Reservation in Monterey County, that past cultivation, including historical disking that may not be at all obvious today, may have had much more of an impact on replacement of native perennial grass stands than previously realized. They note that old fields within the Reservation, ungrazed now for more than 60 years, have remained relatively unchanged, with annual grasses dominating, and few, if any, perennial grasses moving back in. They hypothesize that the initial cultivation eliminated the perennial grasses, and that gopher activity in these old fields has helped to maintain the annual grasses at the expense of the perennials following the cessation of cultivation.

The present-day grasslands are dominated by annual grasses and forbs in the ground layer. Practically all of the annual grasses were introduced from Europe and are now naturalized to the extent that Heady (1977) believes they must be considered "new natives." Common among these are soft chess (*Bromus hordeaceus*), ripgut (*B. diandrus*), red brome (*B. madritensis* ssp. *rubens*), wild oat (*Avena fatua*), slender wild oat (*A. barbata*), European hairgrass (*Aira caryophylla*), dogtail (*Cynosurus echinatus*), along with many others. Annual forbs are also common in the grassland. Some of these, such as filaree (*Erodium cicutarium*), storksbill (*E. botrys*), and various species of mustard (*Brassica* spp.), are, like the annual grasses, introduced from Europe. Many others, however, are natives. These include goldfields (*Lasthenia* spp.), butter-and-eggs (*Triphysaria eriantha*), various species of lupines (*Lupinus* spp.), owl's-clovers (*Castilleja* spp.), clarkia (*Clarkia* spp.), and many more. Also common are native perennial herbs from the lily family, such as blue dicks (*Dichelostemma capitatum*), wild onions (*Allium* spp.), mariposa lilies (*Calochortus* spp.), soap root (*Chlorogalum pomeridianum*), and brodiaea (*Brodiaea* spp.).

Although they do not come close to their former dominance, native perennial grasses have not disappeared from the annual grasslands. Large stands of these grasses are rare, however, and even where they are found annual grasses are intermingled with them. The exception to this is on serpentine substrate, where perennial bunchgrasses often still dominate, except where the soil has been disturbed by gophers (Hobbs and Mooney 1985) and heavy livestock grazing (Willoughby, unpub. data). Efforts to restore areas within the annual grassland type to perennial grasslands have increased in recent years. The Nature Conservancy (TNC) has been particularly active in some of these efforts at various preserves throughout the State.

TNC, BLM, and the California Department of Fish and Game are collaborating in attempting to restore portions of the Carrizo Plain to perennial grassland.

Vegetation Dynamics. The annual grasslands vary in species composition and total production both geographically and temporally. Precipitation is probably the most significant driving force behind both types of variation. With respect to geographical variation, Janes (1969, summarized in Heady 1977) sampled 20 sites along a transect running from the southern San Joaquin Valley north to southern Humboldt County. Soil depth, aspect, and percent slope were similar at each site. Average rainfall, based on data from the weather station nearest each site, ranged from 13 cm in the south to 204 cm in the north. On sites with less than 19 cm of rainfall, red brome and filaree were the dominant species; these species continued to occur in measurable quantities up to about 30 cm of rainfall. Soft chess, ripgut, and storksbill were the most common species above 20 cm of rainfall. Large differences in species composition and production can be found over short distances (McNaughton 1968). In addition to rainfall differences, microtopographical differences are important in explaining these differences (Evans and Young 1989).

Temporal variation is equally apparent in annual grasslands. Tremendous differences in species composition and total production occur at the same site in different years. This is primarily a function of the amount and timing of rainfall and fall temperatures (Pitt and Heady 1978; Sawyer and Keeler-Wolf 1995). Bartolome (1976) and Bartolome et al. (1980) have shown, however, that, in addition to weather, the amount of residual dry matter (RDM) left on a site at the beginning of the fall rains has a marked influence on total production of that site in the following spring. Heady (1977) summarizes research on the influence of RDM on species composition. Sampson et al. (1951) showed shorter species prevail under heavy grazing (low RDM at the beginning of the growing season), whereas taller species dominate with lighter grazing pressure (high RDM at the beginning of the growing season). Table 3.3.2, reproduced from Heady (1977), lists those species usually found in what Heady calls low, middle, and climax stages of succession. These stages correspond roughly to low, medium, and high amounts of RDM, respectively.

TABLE 3.3.2: Plants Usually Found in Climax, Middle and Low Successional Stages*		
Climax	Middle in Succession	Low in Succession
Slender wild oat	American wild carrot (*Daucus pusillus*) (N)	European hairgrass
Wild oat	Storksbill	Little quaking grass (*Briza minor*)
Soft chess	Brome fescue (*Vulpia bromoides*)	Turkey mullein (*Eremocarpus setigerus*) (N)
Ripgut	Rattail fescue (*Vulpia myuros*)	Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*)
Red brome	Nit grass (*Gastridium ventricosum*)	Tarweeds (*Madia* spp.) (N)
Filaree	Burclover (*Medicago polymorpha*)	Miniature lupine (*Lupinus bicolor*) (N)
Medusahead		Clovers (*Trifolium* spp.) (N)

* These successional stages correspond to high, medium, and low amounts of RDM, respectively, at the beginning of the growing season in the fall. Scientific names are given for those species not discussed in the text. (N) = native species.

Fire likely played an important role in the pristine grassland and was one of the driving forces behind its evolution (Heady 1972). Heady (1977) surmises that burning in the grassland likely decreased following the discovery of gold, because increased cultivation and overgrazing reduced the amount of fuel available. In more recent times fires suppression activities have reduced the extent of fires in the annual grasslands. Heady (1977) maintains that fires in the current annual grasslands have little permanent effect. Where perennial grasses still persist, however, there is at least circumstantial evidence to suggest that repeated burning favors these at the expense of annual grasses. D. Taylor (per. comm.) has studied the grasslands at the Lawrence Livermore Lab's Site 300 facility near Livermore. Grazing was removed from the property in the early 1940's. About half of the acreage has been burned annually in late spring to reduce the fire hazard, while the rest of the facility has remained unburned (except for occasional wildfire). After more than 50 years of no grazing the unburned portion remains dominated by annual grasses such as ripgut and soft chess. The burned portion, though still supporting annual grasses, has what Dr. Taylor describes as some of the best stands of native grassland he has seen in the California Floristic Province. These stands are dominated by one-sided bluegrass.

Fire also appears to provide a tool for eliminating or at least controlling the invasive weed, medusahead (*Taeniatherum caput-medusae*). Although Heady (1977) states that fire is ineffectual in controlling this species, The Nature Conservancy has had considerable success in recent years in eliminating this species from its Jepson Prairie Preserve in Solano County by burning in late spring, before medusahead, a late-maturing species, has set seed (Pollak and Kan, in press).

In addition to medusahead, yellow-star thistle (*Centaurea solstitialis*) is an important weed pest of annual grasslands. Besides being poisonous to horses, this introduced weed out-competes native plants and reduces biological diversity. Yellow-star thistle is so widespread in the annual grassland that until recently there appeared little hope for control. The U.S. Department of Agriculture and California Department of Food and Agriculture are experimenting with biological control agents. One of these, the hairy weevil (*Eustenopus villosus*), which preys on the seed heads of the plant, was recently released on BLM lands in the Carrizo Plain Natural Area (it has been used on private lands for about the last five years). Fire has also been used effectively. For example, Hastings and DiTomaso (1996) report that three years of burning at Sugarloaf Ridge State Park in Sonoma County have resulted in a 99 percent decrease in the soil seed bank of yellow star-thistle. Victory over this species on a large-scale basis, however, remains many years away.

In the San Joaquin Valley, introduced and native plants serve as hosts to the beet leafhopper, an introduced species that is the vector of curly top virus, an economically important disease of tomatoes, sugar beets, beans, melons, and several species of ornamental flowering plants. Key host plants in the late winter and spring are grassland species, including filaree, annual plantain (*Plantago erecta*), and annual peppergrass (*Lepidium nitidum*). These are species that frequent dry, sparsely vegetated south-facing slopes. These species tend to be more numerous in dry years and/or in areas that are too heavily grazed, and these situations consequently favor the beet leafhopper. During the summer season the most important plant host for the leafhopper is Russian thistle (*Salsola tragus*), which is often the only green, succulent plant remaining on many rangeland sites during that time of the year. Russian thistle usually invades sites that have been physically disturbed. Although many factors such as fires, roads, or surface blading provide opportunities for the invasion of Russian thistle, improper livestock grazing, too, can play a role in its spread.

Vernal Pools. Vernal pools are an important feature of many of the annual grasslands of California. These are small depressions, usually underlain by hardpan, that fill with water during the winter (Holland and Jain 1977). As these pools dry up in the spring, many plant species flower, often forming showy rings around the pool. Many of the plant species found in vernal pools are totally restricted to that habitat. Because of the demanding nature of the vernal pool habitat--requiring species to begin growth while submerged in water--most of the introduced grassland species have not been able to successfully colonize vernal pools. The result is that most vernal pool species are native. Characteristic vernal pool species include various species of downingia (*Downingia* spp.), (*Lasthenia* spp.), coyote-thistle (*Eryngium* spp.), popcorn flowers (*Plagiobothrys* spp.), meadowfoams (*Limnanthes* spp.), water pygmy (*Crassula aquatica*), water-starwort (*Callitriche marginata*), semaphore grass *(Pleuropogon calicornicus*), and whiteflower navarretia (*Navarretia leucocephala*).

Many vernal pool habitats have been lost to farming and urbanization. As a result, several animal and plant species that live in vernal pools have been listed as threatened or endangered by the U.S. Fish and Wildlife Service.

Barry (1995) reviewed the effects of livestock grazing on vernal pools. While recognizing that improperly managed grazing can have deleterious effects both on vernal pools and surrounding annual grassland communities, she asserts that properly managed grazing maintains and enhances vernal pool vegetation by preventing the invasion of weedy species. Stone et al. (1988) noted that moderate grazing (defined as leaving at least 300-600 pounds of residual dry matter following grazing) had little impact on members of the rare grass tribe Orcuttieae -- of which two species, slender orcutt grass (*Orcuttia tenuis*) and San Joaquin Valley orcutt grass (*Orcuttia inaequalis*) occur on BLM lands. The only possible exception to this conclusion is Greene's tuctoria (*Tuctoria greenei*), a species that is not known to occur on BLM lands. Zedler (1987), in looking at Southern California vernal pools, concluded that moderate cattle or horse grazing does not seem to threaten the persistence of vernal pool plants. This also was the consensus of vernal pool experts at a January 21-22, 1997, meeting of the U.S. Fish and Wildlife Service Central Valley Vernal Pool Recovery Team, where those present agreed that properly managed livestock grazing is compatible with the recovery of listed and candidate vernal pool plants and animals (John Willoughby, pers. comm.). Certainly the fact that vernal pool habitats continue to function more than 200 years following the introduction of domestic livestock into California is evidence for the compatibility of livestock grazing, at least at certain levels, with vernal pool habitat.

Effects of grazing on shrubs and trees associated with annual grasslands. Although grasses and other herbaceous plant species are considered the most desirable livestock forage and provide the major source of forage for livestock, shrubs and tree species, particularly at the seedling and juvenile stages, often are consumed or trampled by livestock. Some woody species have been negatively affected by the season-long grazing that has historically occurred on annual rangelands. Allscale, a common shrub of annual rangelands in the southern San Joaquin Valley, has been particularly impacted. Its range and extent appears to have been greatly reduced even in the last hundred years. Ian McMillan, long-time cattleman and naturalist in the area, has given the following statement with respect to this species (quoted in Sampson and Jesperson 1963; the "*Atriplex*" referred to in McMillan's statement is *Atriplex polycarpa*, allscale):

> As a boy I learned from the old vaqueros, that fat cattle were marketed in early spring off the ranges along the west side of the San Joaquin Valley that were then shrub-grassland with *Atriplex* the dominant shrub. This plant feeds from a deep taproot in the sub-surface strata and puts out succulent, nutritious foliage in the fall months when other forage is dry. It blooms and seeds in late fall. This fall growing habit and the ability to put out new growth in dry years when annual plants fail, makes this plant a 'sitting duck' for intensive year-round grazing practices. On the other hand, when browsed only to the extent of annual increment, the plants thrive, and I know of stands that have been pastured on this basis as long as I can remember....If I were running things in the interests of long term human welfare the *Atriplex* would be given back a big portion of its former domain.

Thus, timing of grazing can allow livestock to make use of annual plant species, while minimizing deleterious use of allscale. Moving livestock from pastures in which these annuals have begun to dry out and before or shortly after their dietary switch to allscale can ensure that adult allscale plants remain vigorous.

Recruitment of new allscale plants appears to be a rather rare, episodic event. Many areas that were devoid of this shrub experienced seedling flushes in 1991, presumably because of the unusual weather pattern of the winter-spring of 1990-1991. Virtually no rain fell in the southern San Joaquin Valley throughout most of the late fall and winter period, when a series of March storms dropped considerable amounts of rain (the event has been dubbed the "March miracle"). This late rain triggered an explosion of seedlings of allscale. Likely because of reduced competition from annual grasses (very few grasses were to be found that spring) and a relatively mild summer, many of these seedlings have survived into adult plants. This underscores one of the tenants of grazing management in arid environments -- the need to take advantage of these episodic events which may occur on the order of only once every several decades. This has been termed "opportunistic management" by Westoby et al. (1989). Normal grazing during one of these favorable growth years for a desirable species may result in a failure to take advantage of a rare opportunity for range improvement.

Another concern with respect to woody species on annual rangelands has to do with the impacts of livestock grazing on the recruitment of oak species, particularly blue oak and valley oak. Many investigations and studies have looked at the possible negative effect of livestock grazing on the recruitment of these species. Some studies have found that, contrary to popular perception, recruitment is not as rare as once believed (Standiford et al. 1996). Nevertheless, poor recruitment from acorns does occur in many stands as a result of several factors, including: competition from introduced annual grasses; herbivory of seedlings by insects, domestic livestock, and wildlife; and intolerance of shady conditions under dense overstory canopies (Garrison and Standiford 1996). Stand disturbances that create small openings may be necessary for recruitment (Garrison and Standiford 1996).

Holzman (1993) found that blue oak canopy density and basal area at the stand level has increased over the period of 1932-1992 under typical livestock grazing and fire exclusion practices. Davis (1995) looked at changes between 1940 to 1988 at 708 sites in blue oak and blue oak/foothill pine woodland. He found that large changes in tree cover occur within individual stands, but that on the whole the overall cover of blue oaks remained fairly constant over this 48 year period. As he points out, however, this may not be a long enough time period to detect a possible decline in oak cover under present recruitment rates. He also points out that it is possible that the demography of blue oak is much more dynamic than assumed and that existing age and size structure data may not accurately predict future demographic changes.

Sagebrush Steppe

The major vegetation type called sagebrush steppe occurs in the Great Basin Floristic Province, east of the Sierra Nevada-Cascade axis. Sagebrush steppe occupies large areas of the Modoc Plateau in northeastern California, extending eastward into northwestern Nevada and southward on the east side of the Sierra Nevada to the Owens Valley (West 1988). As its name implies, the vegetation type is dominated by various species and subspecies of sagebrush (*Artemisia* spp.), but we also include in this discussion the salt desert vegetation of the pluvial basins (Young et al. 1977), even though these often contain no species of sagebrush. Also included here are communities dominated by northern juniper (*Juniperus occidentalis* var. *occidentalis*) in northeastern California and northwestern Nevada, and by Utah juniper (*Juniperus osteosperma*) and single-leaf pinyon (*Pinus monophylla*) in Mono and Inyo Counties.

The sagebrush steppe vegetation of today is greatly different from that of presettlement times. The pristine vegetation consisted of several species and subspecies of sagebrush, each dominating in different habitats. The most conspicuous sagebrush is big sagebrush *(Artemisia tridentata*), with several subspecies, but other sagebrush species are also important, including low sagebrush (*A. arbuscula*), black sagebrush (*A. nova*), silver sagebrush (*A. cana* ssp. *bolanderi*), and budsage (*A. spinescens*). Big sagebrush and low sagebrush dominate the largest portions of the sagebrush steppe vegetation within the EIS area, with big sagebrush dominating on deeper soils and low sagebrush dominating on shallow, rocky soils with high clay content (Young et al. 1977).

Several species of perennial grasses co-dominated with both big sagebrush and low sagebrush in the pristine sagebrush steppe. The most important of these was probably bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*; West 1988).[3] In more moist areas, such as on steep, north-facing slopes, Idaho fescue (*Festuca idahoensis*) was the dominant grass (Young et al. 1977). On drier sites various species of needlegrasses became important, including Thurber's needlegrass (*Achnatherum thurberianum*), western needlegrass (*A. occidentalis*), and Letterman's needlegrass (*A. lettermanii*). On moist alluvial bottomlands basin wildrye (*Leymus cinereus*) was often the dominant grass (Young et al. 1977). This spectacular grass grows to heights as great as 2 meters, and its seeds were an important food source for Great Basin Indians (Young et al. 1977; Cronquist et al. 1977). Indian ricegrass (*Achnatherum hymenoides*) was another important understory grass, dominant in many areas, particularly where soils were sandy.

The presettlement vegetation was not static. Since the end of the Pleistocene, about 10,000 years ago, there have been changes in the altitudinal distribution of plant communities and increases and decreases in the abundance of salt desert species and of upland shrubs and grasses as a result of changes in climate and fire frequency (Miller et al. 1994). However, as noted by Miller et al. (1994), "...since settlement, approximately 150 years ago, changes in plant/animal composition have occurred at unprecedented rates across the [sagebrush steppe] region."

The introduction of domestic livestock beginning in the 19th century greatly altered the pristine vegetation. Severe overgrazing reduced or completely eliminated perennial grasses in many areas. Basin wildrye communities were particularly hard hit (Young et al. 1977), to the extent that vast expanses of bottomlands still have little perennial grass today (except where species of introduced wheatgrasses have been artificially seeded). At least some of these degraded basin wildrye communities, even those with no evidence of the plant, appear to be able to come back on their own with proper grazing practices, such as later spring grazing or initial rest for a few years (Jim Young, pers. comm.). Bluebunch wheatgrass is notoriously ill-adapted to grazing, particularly during the growing season (Mack and Thompson 1982; Anderson 1991). It, too, has been greatly reduced or eliminated from much of its former range.

---

[3] There is some debate over whether bluebunch wheatgrass was in fact the dominant species on most upland sites. Some range scientists now believe the species was dominant on only a few sites, particularly north slopes at mid-elevations (Roger Farschon, pers. comm.). The latest ecological site descriptions prepared by the Natural Resources Conservation Service are decreasing the percentages of bluebunch wheatgrass thought to be present in the climax plant community and increasing the percentages of Thurber's needlegrass. On the other hand, reference sites with anything approaching the climax or potential plant community are very rare and much of what we believe to represent climax vegetation is based on conjecture. Certainly the fact that bluebunch wheatgrass is known to be severely impacted from livestock grazing in the growing season (Anderson 1991) and the fact that it is still found as a dominant on some flats, rocky areas, and south-facing slopes lends credence to it being a more wide-spread dominant before the introduction of livestock grazing (Gary Schoolcraft, pers. comm.).

The result of the removal of much of the perennial grass understory was an increase in cover and density of shrubs, particularly species of sagebrush. West (1988) suggests that the pre-settlement sagebrush steppe was only weakly stable, because of the competitive disadvantage of the perennial grasses as compared to shrubs. Certainly fire was an important agent in keeping shrubs in check: perennial grasses are resistant to most fires, whereas many shrub species, particularly sagebrush, are readily killed (West 1988; Young et al. 1977). Another important agent of change was the native moth, Sagebrush Defoliator (*Aroga websteri),* which also contributed to reducing the dominance of sagebrush. The larvae of this species periodically become so numerous they defoliate large expanses of sagebrush (Young et al. 1977). Besides killing the sagebrush outright, these outbreaks also increase the flammability of sagebrush communities, leading to a greater risk of fire.

The severe reduction in perennial grass understory that was the result of the tremendous grazing pressure of the late 19th and early 20th centuries both reduced the competition of perennial grasses on shrubs and decreased the likelihood of fire. Both of these changes led to a greatly increased dominance of shrubs.

The introduction of invasive weeds, most notably cheatgrass (*Bromus tectorum*), has further reduced the perennial grass component of the sagebrush steppe. Cheatgrass became the dominant understory plant in much of the sagebrush steppe by the 1940s and 1950s (Mack 1981; West 1988). Cheatgrass out-competes the native perennial grasses by its ability to germinate in the fall and add root tissue throughout the winter (Harris 1977). It poses the greatest threat to salt desert shrub sites and low precipitation sites dominated by Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). More recently, medusahead (*Taeniatherum caput-medusae*) has invaded large areas of sagebrush steppe, principally on the heavy clays of low sagebrush sites. The addition of the fine fuels provided by cheatgrass and medusahead calls the future of even the shrubs on some sites into question. Fires are more likely to occur on these sites than they were even when perennial species were ungrazed. The first fire results in a decrease in sagebrush and an increase in shrubs that have the ability to resprout after fires, such as rabbitbrush (*Chrysothamnus* spp.). As fires become more and more frequent, even these shrubs disappear and the site becomes completely dominated by annuals. Annual grasses do not provide nearly the soil protection of perennial species, particularly in drought years. As West (1988) points out, this results in severe soil erosion during summer convectional storms and a downward spiral of degradation.

Species of shrubs other than sagebrush are also important in the sagebrush steppe vegetation type. Bitterbrush (*Purshia tridentata var. tridentata*) co-dominates with both big and low sagebrush in some areas (Young et al. 1977). It is the most important wildlife browse species of this vegetation type (Nord 1965). Other important shrub species in the sagebrush shrub vegetation type include those of the salt desert scrub, discussed below, and those that belong to what Young et al. (1977) refer to as mountain brush communities. Mountain brush communities are those Great Basin plant communities that occur at high elevations and are composed of several species of shrubs. Bitterbrush is one of these. Others are curl-leaf mountain mahogany (*Cercocarpus ledifolius*), Utah service-berry (*Amalanchier utahensis*), and snowberry (*Symphoricarpos rotundifolius*).

Grazing effects on shrubs in the sagebrush steppe vegetation type. Several shrubs in the rose family (Rosaceae) are palatable to both wildlife and livestock. The most important of these is bitterbrush. Bitterbrush provides important browse for big game species, as well as small mammals and both game and nongame birds (Dittberner and Olson 1983). It is also utilized by livestock. Much recent attention has focused on the health of bitterbrush stands, particularly in northeastern California and northwestern Nevada, and the relationship of these stands to the health of mule deer herds. Heaviest use of bitterbrush by mule deer occurs a short time before the leaves are shed in late fall (Sampson and Jesperson 1963). This is also the time of year during which the nonstructural carbohydrate reserve is highest; browsing during this period is therefore least damaging to the plant (McConnell and Garrison 1966). Domestic livestock will browse the plant in summer and early fall, when most of the herbaceous species have begun to dry out and are less palatable. Cattle normally make no use of bitterbrush in the spring.   Over-utilization, whether by livestock, mule deer, or a combination of both, results in thinning of stands (Lassen et al. 1952).

There are a number of studies evaluating the impact of browsing on bitterbrush. Urness and Jensen (1982) reported on a study assessing the impact to bitterbrush by goats (which have browsing patterns similar to sheep). They found that fall browsing of bitterbrush by goats at 100 percent of the annual growth resulted in an increase in the average leader length the following year (55.6 cm as opposed to 7.4 cm in unbrowsed controls), but an order of magnitude reduction in the number of buds and twigs. The actual production increased by 719 percent. Jones (1983), in a manual clipping and mowing study, found that bitterbrush responded to these treatments with increased growth. He states “the more heavily the bitterbrush was pruned, the better it responded to increased growth.” However, he also estimated 5 to 8 percent bitterbrush mortality, but he does not specify if this mortality was increased by heavier clipping levels. Fall mowing resulted in a four-fold increase in leader lengths the following year, as opposed to only a two-fold increase from spring mowing. This is consistent with the changes in the amount of available, nonstructural carbohydrates in bitterbrush found by McConnell and Garrison (1966).

Although heavy browsing, particularly when it occurs before fall, stimulates increased production of individual plants, it can also result in shorter shrub life and fewer shrubs surviving to the age of maximum production (McConnell and Smith 1977). Safe utilization (by all animals combined) is considered to be less than 60 percent of current twig length each season (Sampson and Jesperson 1963), although, as we have seen, heavy use in late fall is of less concern than heavy use earlier in the growing season.

There are several examples of bitterbrush stands within the EIS area that are in a decadent condition. These stands receive very heavy use from a combination of deer and livestock, and their current condition may be due to this overuse. It is also possible, however, that old age may be the predominant factor. Hart (1988) attributed a bitterbrush die-off near Ravendale, California, to the old age of the stands.

Bitterbrush reproduces primarily from seed. Rodents play an important role in bitterbrush reproduction by caching the seed in groups of 10 to 100 in storage areas. Although they return to caches to eat the seeds or graze on emergent seedlings, they may miss caches or may not graze every seedling in a group. It has been estimated that up to 50 percent of mature shrubs originated from rodent caches (Martin and Driver 1983). Recruitment of new bitterbrush plants requires the convergence of several conditions (USDA Forest Service 1997): (1) a heavy seed crop; (2) a balanced rodent population (i.e., enough to cache seed, but not so many that all seeds and seedlings are consumed); (3) good spring soil moisture; and (4) circumstances favorable for early seedling growth. In some areas all of these conditions occur only about once every 20 years (USDA Forest Service 1997). When these episodic recruitment events occur it is important to take advantage of them through "opportunistic management" (Westoby et al. 1989) by reducing or eliminating livestock and controlling use by mule deer and other game animals as needed to allow these seedlings to become established plants.

Bitterbrush is a widespread increaser species on loamy to sandy soils on much of the Great Basin. On public lands subjected to livestock grazing, the most important bitterbrush site is on upland loams in the 12-16 inch precipitation zone. Prior to the introduction of domestic livestock, bitterbrush was probably a minor component of this site, and most of the area covered by this site was likely a sagebrush steppe, dominated by sagebrush, bluebunch wheatgrass, and Idaho fescue. Livestock grazing reduced the bunch grass competition, opening the site for colonization by other species, and reduced the fire frequency. Bitterbrush took full advantage of this opportunity and became a dominant or subdominant shrub on thousands of acres (see Gruell 1986). Based on the recent remeasurement of bitterbrush transects originally measured in the 1950s, Eric Loft (pers. comm.) concludes that existing stands in northeastern California are maintaining themselves.

Salt desert scrub. Landforms below the maximum shorelines of the pluvial lake basins within the area of sagebrush steppe support very different plant communities than those discussed so far (Young et al. 1977). Big sagebrush and low sagebrush are greatly reduced in importance, if they are present at all. Taking their place are other species of shrubs, including shadscale (*Atriplex confertifolia*), greasewood (*Sarcobatus vermiculatus*), winter fat (*Krascheninnikovia lanata*), budsage, and spiny hop-sage (*Grayia spinosa*). Many of the same grass species discussed previously occur here as well, particularly Indian rice grass and basin wildrye. An additional grass species is saltgrass (*Distichlis spicata*). These communities experienced the same grazing pressures as the big sagebrush and low sagebrush plant communities, with the consequence that basin wildrye and other perennial grasses have been greatly reduced or have disappeared altogether from many areas. In addition, budsage and winter fat are very palatable to livestock, particularly sheep. These, too, have been greatly reduced from pre-settlement numbers.

Salt desert scrub communities have also experienced invasion from invasive weeds. In addition to cheatgrass, which is also a problem in these communities (see above), tumblemustard (*Sisymbrium altissimum*) and clasping-leaved peppergrass (*Lepidium perfoliatum*) have invaded salt desert scrub sites. Although apparently posing a more extensive problem elsewhere in the Great Basin, weedy species such as Russian thistle (*Salsola tragus*), halogeton (*Halogeton glomeratus*), and annual, nonnative saltbush (*Atriplex* spp.) and pigweed (*Chenopodium* spp.) tend to invade only physically disturbed sites in the salt desert shrub communities of California.

As mentioned, livestock browse on several shrubs found in salt desert scrub communities, including winter fat, budsage, and some of the salt bushes (*Atriplex* spp.). Clary and Holmgren (1987) evaluated studies conducted on the Desert Experimental Range in Utah to determine long-term vegetation trends in these communities. They found that, because of differences in study methods, weather, grazing treatments, and viewpoint, it was impossible to draw many conclusions. They did find, however, that spring grazing increased shadscale and eliminated budsage at every grazing level. Fall grazing has the opposite effect. Winterfat appears to have declined under both the fall-winter grazing and no grazing treatments.

Not a large amount of these types of communities is grazed within the EIS area. Where livestock grazing in these communities does occur, it takes place primarily in the spring, when the grazing animals prefer grasses.

Juniper and pinyon woodlands. Woodlands of pinyon and/or juniper occur adjacent to sagebrush steppe at higher elevations. Extensive woodlands dominated by western juniper occur on the Modoc Plateau of northeastern California and the Great Basin of northwestern Nevada. The extensive pinyon-juniper woodlands of the Great Basin of Nevada extend into the mountainous areas east of the Sierra Nevada, from Alpine county south (Vasek and Thorne 1977). Throughout this area, woodlands consist of single-leaf pinyons alone, of Utah junipers alone, or as a mixture of the two. Pinyon also occurs on the lower east slopes of the Sierra, where it occurs without Utah juniper in an almost continuous band from Topaz Lake at the Nevada state line south to Kern County (Vasek and Thorne 1977). Where both single-leaf pinyon and Utah juniper occur together, they usually co-dominate at intermediate elevations, with Utah juniper extending by itself to lower elevations and single-leaf pinyon occurring by itself at higher elevations. An exception is the region south and west of Bodie, where Utah junipers occur at the upper elevational margin of a single-leaf pinyon woodland (Vasek and Thorne 1977).

Single-leaf pinyon and both species of junipers have increased greatly since pre-settlement times. This is particularly true of western juniper on the Modoc Plateau, where trees have encroached significantly into communities formerly dominated by sagebrush species. West (1984 and 1988) believes that much of the pinyon-juniper and juniper woodland of the Great Basin was formerly more like a savannah, with older trees restricted to rocky and steep areas, where fires did not reach. Elsewhere the fine fuels provided by understory perennial grasses were sufficient to ensure fires at a frequency that removed juvenile and younger age-class trees from the community. Heavy livestock grazing removed or greatly reduced these fine fuels, leading to a decrease in fire frequency and a consequent increase in the number and cover first of shrubs, especially sagebrush, and then of junipers. Fire suppression policies have also greatly decreased the role of fire in these communities. The result has been that junipers have increased in density both up and down slope into sagebrush steppe.

The understory of the pristine juniper woodlands was very similar to the adjoining sagebrush steppe (West 1988). As juniper density increased over the last ~100 years, however, the understory was much reduced, both in numbers of species and degree of cover. There are large areas on the Modoc Plateau where western juniper is so dense there is no shrub or herbaceous perennial understory whatsoever. The only plants present in the understories are annuals, primarily cheatgrass, and even these exhibit low cover and vigor. West (1988) notes that because of extensive root systems, shading, and germination-inhibiting chemicals in their leaves, junipers are at a distinct competitive advantage over other species. Because the interspaces between trees are devoid of much ground cover, erosion rates in juniper and pinyon-juniper woodlands have accelerated beyond those of the sagebrush steppe. Carrara and Carroll (1979) have demonstrated that soil erosion rates in pinyon-juniper woodland in the Piceance Basin of Colorado have increased 400% during the past century.

Efforts have been made to control the spread of junipers. Prescribed burning is a valuable tool, but it is effective only with younger age-class junipers, because prescribed burns are not usually hot enough to kill older trees. Mechanical removal of junipers has also been used, including fuel wood harvest and chaining. Although locally effective, these practices have not done much to stem the overall spread of junipers into sagebrush steppe. An additional problem is that, once the junipers have reached a density that has eliminated most of the understory, removal of the trees through any method usually results in a community dominated solely by cheatgrass or other annual plants unless the removal is followed by a restoration effort. This is because seed banks and other sources of perennial grass seed have been lost (Koniak and Everett 1982). This result is probably even more undesirable than the juniper woodland.

Although fire and overgrazing have doubtless contributed to the expansion of pinyon-juniper and juniper woodlands, there is evidence that climate, too, has played a major role. Some scientists now think that the spread of junipers into sagebrush steppe in northeastern California and eastern Oregon may be correlated with the more moist period of the last 100 years (Richard Miller, pers. comm.) paralleling the expansion of mesquite (*Prosopis* spp.) into the grasslands of the southwestern deserts of New Mexico and Texas.

Blackbrush Scrub. In Inyo County, where the Great Basin and Mojave Desert merge, is a locally important community dominated by blackbrush (*Coleogyne ramosissima*; this shrub is also called blackbush), a shrubby member of the rose family. Blackbrush is often the only shrub in this community, and herbaceous understory species are few; total vegetation cover, however, is often high (West 1988). Perennial grasses, including galleta (*Pleuraphis jamesii*), Indian rice grass, and various species of needlegrass (*Achnatherum* spp.), do occur in this community, where they have not been removed through heavy livestock grazing. Once these understory species are removed from a blackbrush community, they will not re-occur unless the blackbrush is removed; thus, we often see closed communities of blackbrush that last for decades, unless disturbed by fire.

This community is very prone to fire (West 1988), and fire was doubtless important in its evolution (Bates and Menke 1984). Blackbrush does not resprout following fire and reseeds itself with difficulty (West 1988). Where few to no perennials occur in the understory, burning results in at least temporary replacement of blackbrush with annual grasses such as cheatgrass and red brome. When this happens, fire frequencies increase, leading to possible long-term removal of the perennial component of this community, decreased productivity, and increased soil erosion. Surface disturbances have similar affects upon the community as fire, in that once the blackbrush is removed, other species such as annuals, perennial grasses and rabbitbrush may invade the site with little likelihood that blackbrush will reinhabit the site for many years.

Pure blackbrush communities are normally avoided by livestock due to the absence of any appreciable amount of palatable forage. However, once a site is disturbed, herbaceous species usually move in quickly, attracting grazing animals once again. If the grazing is not properly managed, the site may eventually be overgrown with blackbrush again.

Table 3.3.2(a): **Vegetation types compared to wildlife habitat and vegetation series descriptions.**		
Vegetation Type as described in this document	Corresponding Wildlife Habitat Type as described in Mayer and Laudenslayer (1988)	Representative and widespread Vegetation Series as described by Sawyer and Keeler-Wolf (1995).*
Annual Grasslands	Annual Grasslands Alkali Desert Scrub Valley Foothill Hardwood Blue Oak Woodland Valley Oak Woodland Coastal Oak Woodland Valley Foothill Hardwood-conifer Blue Oak - Digger Pine Montane Hardwood Chamise-Red Shank Chaparral Mixed Chaparral	California Annual Grassland Series Purple Needlegrass Series Vernal Pools Shadscale Series Iodine Bush Series Greasewood Series Foothill Pine Series Blue Oak Series Valley Oak Series Interior Live Oak Series Black Oak Series Tanoak Series Oregon White Oak Series Canyon Live Oak Series Chamise Series Eastwood Manzanita Series Wedgeleaf Ceanothus Series Chamise-Wedgeleaf Ceanothus Series Scruboak-Chamise Series
Sagebrush Steppe	Sagebrush Bitterbrush Low Sagebrush Pinyon-Juniper Juniper	Big Sagebrush Series Low Sagebrush Series Bitterbrush Series Curlleaf Mountain-Mahogany Series Rabbitbrush Series Black Bush Series Cheatgrass Series Western Juniper Series Utah Juniper Series Single Leaf Pinyon Series Single Leaf Pinyon-Utah Juniper Series

Table 3.3.2(a): Vegetation types compared to wildlife habitat and vegetation series descriptions.		
Vegetation Type as described in this document	Corresponding Wildlife Habitat Type as described in Mayer and Laudenslayer (1988)	Representative and widespread Vegetation Series as described by Sawyer and Keeler-Wolf (1995).*
Wetland-Riparian	Valley Foothill Riparian Montane Riparian Wet Meadow Fresh Emergent Wetland	Fremont Cottonwood Series California Sycamore Series Arroyo Willow Series Narrowleaf Willow Series Sandbar Willow Series Aspen Series Black Cottonwood Series Sedge Series Nebraska Sedge Series Spikerush Series Shorthair Sedge Series Cattail Series Bulrush Series

* No attempt is made to include all applicable vegetation series from the latter source; rather, only those thought to be the most important or most representative of the vegetation types represented in this document are included.

3.3.3 Upland Conditions and Trends

Conditions and trends on BLM rangelands have been reported in a variety of ways over the years. For the past two decades or so the system used by BLM has been substantially the same as that employed by the National Resource Conservation Service (NRCS, formerly the Soil Conservation Service, SCS). The method used is that described in the National Range Handbook (SCS 1976). The BLM has modified the method slightly (BLM 1984) but the basic principles are the same. Differences are primarily in terminology: for example, NRCS uses the term *range site* instead of the *ecological site* used by BLM; NRCS uses the term *range condition*, whereas BLM uses *ecological status*. As long as one is dealing with rangelands these terms are synonymous.

Under this system rangelands are classified into ecological sites. An ecological site is a kind of land with a specific potential natural community and specific physical site characteristics, differing from other kinds of lands in its ability to produce vegetation and to respond to land management.[4] The potential natural community (PNC) for each ecological site is described (usually by NRCS) based on vegetation sampling of an undisturbed expression (or, as is often the case, a *relatively* undisturbed expression) of the site's vegetation in another place. An inventory, called an *ecological site inventory*, is then conducted.

[4] NRCS uses the term *range site* in lieu of ecological site. When it applies to rangelands, a range site is the same as an ecological site. The difference between the two concepts, which will not concern us here, is that range sites apply only to rangelands, whereas ecological sites can apply to woodland and forest sites as well as to rangelands.

Ecological site inventory (ESI) consists of collecting a broad array of information on a given area. The information includes data on soils, vegetation, site history, physiography, and erosion. Of these, soils and vegetation are given paramount importance. Information collected in a given area is extrapolated to other areas based primarily on soils. Thus, several areas can be said to belong to the same ecological site because they have the same soil series (or phase of soil series) even though their current vegetation is different (sites may be further defined based on inches of precipitation). The assumption is that the vegetation of all the areas belonging to one ecological site would be the same if the plant communities on each of these areas were allowed to progress to climax. The fact that the existing vegetation of these areas is different is attributed to the presence of several stages of succession, as well as to different possible expressions of the same stage (see, for example, Huschle and Hironaka 1980).

Ecological site inventory is founded on the work of Dyksterhuis (1949) and is similar in many respects to the habitat type concept of Daubenmire (e.g., 1952; 1970). The method has been attacked because of an underlying assumption that the climax plant community is the best possible community for all uses. This assumption is exemplified in NRCS's use of the terms "poor," "fair," "good," and "excellent" to describe plant communities that are least similar to most similar, respectively, to climax. BLM has avoided this problem by substituting the terms "early seral," "mid seral," "late seral," and "potential natural community (PNC)," respectively, in accordance with the recommendations of the Range Inventory Standardization Committee of the Society for Range Management (RISC 1983).

Range condition (this is called ecological status by BLM, but for simplicity we will refer to it as range condition) is determined based on the percent similarity of the present plant community to the potential plant community. Table 3.3.3 shows the four condition classes used by BLM and NRCS and the percent similarity corresponding to each.

Table 3.3.3: Range condition and ecological status designations corresponding to different levels of similarity of the present plant community to the potential natural community (PNC).

Similarity of Present Plant Community to PNC	Range Condition (as used by NRCS)	Ecological Status (as used by BLM)
76-100%	Excellent	PNC
51-75%	Good	Late Seral
26-50%	Fair	Mid Seral
0-25%	Poor	Early Seral

Trend can also be determined using this method by comparing the results of a subsequent inventory to the initial inventory. If the later inventory shows the plant community to be more similar to the PNC the trend is up. If it is less similar the trend is down. If there is no change, the trend is stable.

Because of constraints of time and budget (as well as the applicability of ecological site inventory to annual rangelands--more on this below), BLM in California has conducted ecological site inventory on slightly less than 1.3 million acres of the 4.4 million acres under grazing permit and lease in the project area. Of the acres inventoried using ESI, almost all were inventoried in order to prepare environmental impact statements to comply with the nationwide court order in National Resource Defence Council, Inc. v. Morton (388 F Supp 829, 1974: 527 F 2d 1386, 1976). The last of these "grazing EISs" was completed in 1985. Thus, ecological site inventories for California rangelands are 12 or more years old (except for some smaller areas that were re-inventoried in later years). Table 3.3.3(a) shows the status of ESI in the project area.

Table 3.3.3(a): Status of ecological site inventory in the project area. Acres and years of inventory are shown by Field Office and by planning unit within each Office's jurisdiction.

Field Office	Planning Unit	Year(s) of Inventory	Acres Inventoried
Bishop	Bodie-Coleville	1979-1980	227,068
Eagle Lake	Cal-Neva	1979 [5]	651,405 [5]
	Willow Creek	1980 [6]	294,992 [6]
Redding	Redding	1981	13,558
Surprise	Cowhead-Massacre	1981	101,486

Problems with the use of Ecological Site Inventory (ESI) to determine range condition. The ecological site inventory approach is based on the successional theory of Clements (1916), as applied to rangelands by Dyksterhuis (1949), and further refined by the Soil Conservation Service (SCS 1976). Important assumptions of the approach include (Willoughby 1992): (1) that each ecological site has only one climax, steady state plant community; (2) that secondary succession is simply the reverse of retrogression and proceeds through a series of predictable seral communities; (3) that pioneer species facilitate the invasion and establishment of later seral species; (4) that succession proceeds in a steady, continuous fashion; and (5) that climate remains relatively stable, at least over periods of many decades to hundreds of years. All of these assumptions are severely challenged by current successional theory (see, for example, Connell and Slatyer 1977; Noble 1986; Noble and Slatyer 1980; MacMahon 1980; Niering 1987; Cattelino et al. 1979; Smith 1988 and 1989; Glenn-Lewin 1980; Holling 1973; Walker et al. 1981; Westoby et al. 1989; Friedel 1991; Laycock 1991; and Svjecar and Brown 1991).

Another problem with Ecological Site Inventory is that, although it gathers valuable information, it does not collect certain critical information necessary to determine whether uplands are healthy or in proper functioning condition. The concept of proper functioning condition of uplands is relatively new (the concept is much better developed for riparian areas,

[5] Some of this area was re-inventoried in 1987, when 53,745 acres were inventoried, and in 1994, when another 40,000 acres were inventoried.

[6] In 1988, 32,477 acres of this total were re-inventoried.

where it will be discussed in detail), but its assessment requires information on soil stability and the integrity of ecological processes such as nutrient cycling and energy flow (National Research Council 1994). Although a team of professionals is currently developing ways of incorporating these informational needs into BLM inventory procedures, this has not yet been accomplished, and none of the range condition and trend assessments given below include this type of information.

Current Known Upland Conditions and Trends. Although, as noted above, current methods of assessing range conditions and trends are inadequate to completely evaluate upland rangeland health or proper functioning condition, they provide the only information currently available. The BLM reports annually on the condition and trend of its rangelands. Where available, this information comes from ecological site inventory. As Table 3.3.3(a) shows, however, only 1.3 million acres out of the 4.4 million acres under grazing permit and lease have been inventoried using this methodology. In order to assess the condition and trend of the other 3.1 million acres, a variety of methods has been used. In some areas different inventory methodologies have been employed. In other areas the professional judgement of range conservationists and other resource specialists has provided the best available information.

In the sagebrush steppe vegetation type range condition is based on the nearness of the current plant community to the presumed climax plant community (see Table 3.3.3). In the annual grassland vegetation type a different procedure has been employed. Because this vegetation type is dominated by annual plant species, the traditional model of succession, which ends in a stable plant community dominated by perennial species, is not applicable. Therefore, annual rangelands have been classified as being in “good” condition, unless problems with noxious weeds or erosion have been evident, in which case they have been classified in a lower condition class. In a few areas within the annual grassland type, perennial species *are* present in sufficient numbers to classify using traditional notions of succession, and these areas have been classified in that fashion.

Some formerly poor-condition rangelands have been seeded to introduced perennial grasses that provide erosion control and livestock forage. These *seedings* have mostly been done in the sagebrush steppe vegetation type. Following the removal of the woody overstory (primarily sagebrush) by wildfire or, more rarely, by chemical treatment, perennial wheatgrasses, including desert crested wheatgrass (*Agropyron desertorum*), intermediate wheatgrass (*Elytrigia intermedia*), and tall wheatgrass (*Elytrigia elongata*), all of which are native to Eurasia, were planted. These seedings are rated using professional judgement as to their forage value (called forage condition).

Trend in uplands is even more important than condition when using the method of condition assessment described in detail above. This is because of the relatively slow rates of change in rangeland vegetation, particularly in the sagebrush steppe vegetation type where these concepts of condition and trend most directly apply. Even under conservative stocking levels and exclusion most rangelands would not improve to the next condition class for many decades. Thus, trend is a more sensitive measure of management success.

Three categories of trend are recognized: Up (moving toward the potential natural community), Static (not moving toward or away from the potential natural community), and Down (moving away from the potential natural community). A fourth category, Undetermined, is used for those rangelands where the trend has not been assessed recently.

Trend is assessed on BLM rangelands in California in one of three ways. Where more than one ecological site inventory has been completed in the same region, the results of the second inventory are compared to the results of the first to determine trend. For example, in the first inventory, the area of a particular ecological site in a given pasture may be measured to be 30% similar to the potential natural community (PNC) for that site. The ecological status of this area would be rated as mid seral (or, in NRCS terminology, as fair condition). Ten years later, a second inventory is conducted. Now the same area is measured to be 45% of the PNC. This is still the same condition class, mid seral, but the trend is clearly up.

Although this method probably is the best means of assessing trend under a system that compares existing vegetation to the potential vegetation for an ecological site (but don't forget the overall limitations of this approach, discussed above), it is the method that has been least used. The reason for this is that few rangeland areas in California have been inventoried twice using ESI. In fact, only slightly more than 125,000 acres have been “re-inventoried” using ESI; all of these acres are managed by the Eagle Lake Field Office. For the remaining almost 4.3 million acres, either the concept of “apparent trend” or monitoring data have been used to assess whether the plant community is moving toward or away from the PNC. Apparent trend is the interpretation of trend based on a single observation, using such factors as plant vigor, the abundance of seedlings and young plants, and the accumulation or lack of plant residues (SRM 1989). This determination is made during a rangeland inventory (using either ESI or another inventory method) or by professional judgement.

Monitoring provides another means of estimating trend. Trend monitoring involves the estimation of plant attributes, especially cover and frequency, at key areas (see Section 3.2.5, Monitoring, for a discussion of cover and frequency measurements, as well as the key area concept). A determination of trend involves assessing whether species that are considered to be part of the PNC are increasing or decreasing. Estimates at key areas are extrapolated to include larger areas of pastures or allotments.

Just as for condition, the concept of trend does not really fit well in stable communities dominated by annuals. Therefore, offices have generally reported the trend of annual rangelands to be static unless there are, or have been, problems associated with noxious weeds and/or accelerated erosion.   In a few areas within the annual grassland type, perennial species *are* present in sufficient numbers to classify using traditional concepts of succession. Trend has been determined in these areas based on the methods described for sagebrush steppe rangelands.

Tables 1 through 6 in Appendix 7 show rangeland conditions and trends as of September 30, 1996.

But remember, when we talk about trend and condition as it has been used by BLM, NRCS and others, we are not talking about rangeland health or proper functioning condition (which is what we need to discuss). What we are talking about is whether a site is moving towards a climax vegetative community (which may not be the desired state). In many cases, we are managing for, and desire, a lower seral stage, or a mix of stages spread over the landscape. So, although we may say that the condition is poor, with no upward trend, this does not necessarily mean that these areas are in poor health, but rather that they are at a low seral stage.

3.4 RIPARIAN-WETLANDS and STREAM CHANNELS

3.4.1 Overview

Wetland/aquatic areas comprise less than 1 percent of the 15.9 million acres of public lands administered by the Bureau of Land Management in California. BLM manages 62,000 acres and 3,500 miles of wetlands statewide, and 13,593 acres and 1,163 miles of wetlands in the area covered by this EIS (see Table 3.4.1).

The benefits of these vital areas, however, far exceed their relatively small acreage. Wetland/aquatic habitat is one of the most fundamental resources of the public lands. The water sources contained in these habitats serve as the foundation upon which many species depend. An estimated one-half of the animals and one-third of the plants currently listed in the U.S. as endangered or threatened depend on wetland/aquatic areas for their survival.

Table 3.4.1: BLM California Estimated Wetland Acres and Aquatic/Riparian Miles (most recent data available)

	Acres Land Administered	Standing-water Wetland (Lentic) Acres	Flowing-water Riparian / Aquatic (Lotic) Miles
Area Administered by BLM California	15,900,000	62,000	3,500
Area Covered by this EIS, within Grazing Allotments	4,370,000	13,593	1,163

In recent years, there has been increasing awareness and understanding of the numerous economic benefits wetland/aquatic areas provide to humankind. Healthy wetland systems purify water as it moves through the vegetation and act like a sponge by retaining water in stream banks and ground water aquifers. Wetland/aquatic areas can absorb and dissipate the energy of flood waters before they reach high value areas such as urban lands.

Wetland/aquatic areas also are focal points for recreation, including fishing, hunting, camping, boating, hiking, nature observation, photography, and picnicking. Many of these activities associated with wetland/aquatic areas generate high economic values.

Within a landscape, wetland/aquatic areas are linked to both upstream and downstream ecosystems, and their functional values (e.g., flood storage, water supply, wildlife habitat) extend well beyond the boundaries of the wetlands/aquatic areas themselves. In California, wetland/aquatic area habitat functions extend to other continents, as is the case for 60 percent of migratory birds using the Pacific flyway.

In California, the BLM manages four major types of wetlands: 1) riparian, 2) marshes, 3) wetland flats/playas, and 4) vernal pools. Riparian wetland areas are grouped into two major categories: 1) lotic, which is running water habitat (including stream channel and floodplain) such as rivers, streams, and springs; and, 2) lentic, which is standing water habitat (including shorelines and floodplain) such as lakes, ponds, and meadows.

Marshes are frequently or continually inundated areas characterized by emergent herbaceous vegetation adapted to saturated soil conditions. Wetland flats/playas are similar to a marsh; however, they are very shallow and are seasonally and intermittently flooded.

Vernal pools are depressions that have impervious substrata (clay soils, hardpan, or bedrock). This substrata decreases the infiltration of water and results in areas that are saturated long enough to impose special constraints on plant growth. Many vernal pools have surface water only during the most extreme precipitation events and may persist only a few days, while others may persist up to several months.

The amount of scientific data and history of BLM managed wetland/aquatic habitats varies greatly by location. Some areas (i.e. Mattole River Estuary) have long-term research conducted within the area. However, in other areas information is lacking. The best information available on wetland/aquatic habitats for this EIS is Functioning Condition Assessment data. There are three categories of functioning condition: 1) proper functioning condition, 2) functional-at-risk condition, and 3) non-functional condition. Detailed definitions of these categories are available in BLM's Technical References 1737-9 and 1737-11.

Simply put, the Functioning Condition Assessment process is an evaluation of the health or change of health status of wetland areas. The results of this assessment do not indicate if management objectives are being achieved. However, if an area is not in proper functioning condition it does not have the potential to achieve management objectives. See Table 3.4.1(a) for functioning condition status of wetland/riparian habitats covered by this EIS.

The major stream channel and riparian attributes that are assessed when determining functional condition are hydrologic, vegetative, and soils/erosion. Livestock grazing can impact all of these attributes. For example, livestock could consume enough of the streambank vegetation that there would not be adequate vegetation cover to protect stream banks during high flows. If a stream was not rock armored along its banks and there was not adequate vegetation, the streambank and associated riparian habitat may erode into the stream channel during high flows. This erosion/sediment might be more than the stream channel could handle and cause the channel to decrease in depth and widen. If a stream channel does not have the correct width/depth ratio for the landscape setting in which it occurs, then the stream cannot provide the proper habitat for the fish, frogs, insects, etc., that should occur in that stream.

Table 3.4.1(a): Functioning Condition Status of Lentic and Lotic Habitats Covered by Range EIS[7]		
Condition	**Standing-water (Lentic) Wetland Acres**	**Flowing-water (Lotic) Riparian/Aquatic Miles**
Proper Functioning Condition	3631 (26.7%)	319 (27.5%)
Functional-at-Risk	9667 (71.1%)	807 (69.3%)
Non-functional	295 (2.2%)	37 (3.2%)
TOTALS	13,593	1,163

3.4.2 Wetland-Riparian Vegetation

Wetland-Riparian vegetation occurs in both the California and Great Basin Floristic Provinces. This vegetation type is dependent upon the water provided either by the running water of rivers, streams, and springs (*lotic* habitat) or by the standing water of lakes, ponds, seeps, bogs, and meadows (*lentic* habitat). The vegetation of riparian-wetland areas usually contrasts sharply with the vegetation of the adjacent uplands. Although the area covered by wetland-riparian vegetation is small compared to upland vegetation, the importance of this vegetation to a variety of resources is well recognized. For example, more species and greater numbers of wildlife are found in riparian environments than in any other habitat type (Kattelmann and Embury 1996; Thomas et al. 1979; Kauffman and Krueger 1984; Schulz and Leininger 1991). Wetland-riparian vegetation provides important sources of forage for domestic livestock (Clary and Webster 1990). Riparian vegetation is very important to the proper functioning of the adjacent stream, providing shading and adding chemical energy and nitrogen through the plant materials and insects that fall into the stream (Kattelmann and Embury 1996; Meehan et. al. 1977; Cummins et al. 1989). Riparian vegetation protects streambanks from erosion and traps sediments and nutrients coming from upstream, thereby ensuring high water quality (Kattelmann and Embury 1996). Healthy stands of riparian vegetation can ameliorate the adverse effects of upslope disturbances (Schlosser and Karr 1981).

Wetland-riparian vegetation varies both spatially and temporally. Spatial variation occurs in response to different physical and biological factors. Certain habitats are dominated by winter-deciduous tree species such as Fremont cottonwood (*Populus fremontii*), black cottonwood (*Populus trichocarpa*), Oregon ash (*Fraxinus latifolia*), red willow (*Salix laevigata*), hackberry (*Celtis reticulata*), white alder (*Alnus rhombifolia*), bigleaf maple (*Acer macrophyllum*), and California sycamore (*Platanus racemosa*). Several shrub species occur in

[7] Much of this data derived from a Professional Judgment Assessment (PJA), where resource professionals were asked to use their own personal experience, skill, perspective, and familiarity with various wetland/riparian areas to answer functioning condition standard checklist questions.

these tree dominated habitats, or in other habitats the shrub species themselves are dominant: arroyo willow (*Salix lasiolepis*), sandbar willow (*S. sessilifolia*), narrowleaf willow (*S. exigua*), yellow willow (*S. lutea*), mulefat (*Baccharis salcifolia*), California wild rose (*Rosa californica*), interior rose (*Rosa woodsii* var. *ultramontana*), and California blackberry (*Rubus ursinus*). In other riparian areas and especially in meadows, herbaceous vegetation dominates. Several species of sedge (*Carex* spp.) may dominate separately or in combination. Of particular note are Nebraska sedge (*C. nebrascensis*), beaked sedge (*C. utriculata*), and shorthair sedge (*C. filifolia*), though many other sedge species may be present depending on geography and local factors. Rushes (*Juncus* spp.), spikerushes (*Eleocharis* spp.), and common three-square (*Scirpus pungens*) are also common in these habitats. Where the habitat is permanently or almost permanently flooded, cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.) may occur.

Vegetation dynamics. Temporal variation in wetland-riparian vegetation occurs in response to disturbance. Natural disturbances due to flooding are common in riparian habitats. The degree of change to the vegetation in response to floods, depends upon the severity of an individual flood and the condition of the riparian vegetation at the time of the flood. Very severe floods can remove much of the vegetation. When this happens the vegetation progresses through a series of different successional stages until a relatively stable stage is reached. Manning and Padgett (1995) provide an excellent description of community types and successional pathways of riparian areas in the Great Basin.

Improper management of livestock grazing can have serious adverse effects on wetland-riparian vegetation. Livestock impacts riparian vegetation both through direct consumption of plant material and trampling. The latter affects vegetation by compacting soil, resulting in reduced infiltration, percolation, root growth, and plant production (Clary 1995; Bryant et al. 1972). Kattelmann and Embury (1996) list the following interrelated impacts of overgrazing on wetland-riparian vegetation and wetland-riparian habitat: 1) reduction in vegetative cover; 2) changes in species composition; 3) introduction of exotic species; 4) reduction or elimination of regeneration; 5) compaction and cutting of meadow sod; 6) depletion or elimination of deeply rooted vegetation that strengthens banks; 7) loss of litter and soil organic matter; 8) erosion of stream banks, beds, and flood plains; 9) loss of overhanging streambanks; 10) destabilization of alluvial channels and transformation to wide shallow channels; 11) initiation of gullies and headcuts; 12) channel incision and consequent lowering of water tables; 13) desiccation of meadows; 14) increased water temperature during summer due to reduction of shade; 15) increased freezing in winter from reduction of insulation and snow trapping efficiency; 16) siltation of streams; 17) bacterial and nutrient pollution; and 18) decline of summer streamflow.

Probably all of the wetland-riparian areas on BLM lands have experienced overgrazing in the past. Livestock grazing was essentially unregulated on BLM lands until passage of the Taylor Grazing Act in 1934, and the fact that livestock congregate in riparian areas, particularly in the warm summer months, served to ensure the occurrence of many or all of the impacts listed above. Despite increased management attention to wetland-riparian areas and attempts to improve them, many of which have proven successful, serious problems remain. Improved management of wetland-riparian vegetation is one of the goals of the healthy rangelands initiative.

With respect to recovery, Kattelmann and Embury (1996) state the following:

> Riparian vegetation degraded by overgrazing generally recovers within a decade once grazing pressure is removed (e.g., Platts and Nelson 1985; Chaney et al. 1993; Nelson et al. 1994). As long as gullying has not lowered the water table, riparian and meadow plants will regrow in a few years if not consumed (Odion et al. 1990). However, there are many potential successional pathways (Menke et al. 1996). Channel morphology responds to the cessation of the disturbance much more slowly (Kondolf 1993). Decades to centuries may be required. Rates of recovery tend to be highly variable between locations and depend on the ability of the riparian vegetation to trap sediment and build streambanks.

Relatively rapid recovery of riparian areas can be expected if management is implemented soon enough; otherwise, complete recovery is unlikely in one human generation.

Although complete rest from livestock grazing is one management option for improving riparian areas, other grazing strategies can also result in riparian area improvement (Clary and Webster 1989; Elmore and Kauffman 1994). These include the use of riparian pastures, spring grazing, and attention to stubble height guidelines (with respect to the latter, see also Hall and Bryant 1995).

Weeds have become an important instrument of vegetation change in many wetland-riparian areas. The exotic Himalayan blackberry (*Rubus procerus*) and ailanthus have become established in many of the riparian areas found within the annual grassland vegetation type. Giant reed (*Arundo donax*) has become established in many riparian areas, particularly those in the Coast Ranges. Although not yet the problem it is in the Desert Province, tamarisk (*Tamarix* spp.) is expanding into many riparian areas in the California Floristic Province and the Great Basin. Perennial peppergrass (*Lepidium latifolium*) is also invading many riparian areas throughout the Great Basin. It is easily dispersed through flooding. Anne Halford (pers. comm.) witnessed clumps of perennial peppergrass floating down both the flood-swollen Truckee and Walker Rivers on January 1, 1997.

Managing livestock grazing to prevent overuse and to maintain or enhance the condition of riparian-wetland areas is often very challenging. On most allotments where riparian areas exist, the riparian areas, whether lentic or lotic, normally constitute a very small proportion of the allotment area and are often located in a fragmented pattern throughout each allotment. Although these areas constitute a very small amount of the overall forage available for livestock in each allotment, they are very attractive areas to livestock, because of their proximity to water, shade, and vegetation that remains succulent much longer than the adjacent upland vegetation. Consequently, livestock tend to congregate in these areas and can quickly overuse the riparian vegetation.

Total or seasonal exclusion from grazing usually requires either fencing, which is costly and requires almost continuous maintenance, or herding, which for cattle is very difficult. The herding of sheep is much more practical and has proven quite successful in protecting and enhancing riparian-wetland areas. However, as sheep grazing has declined over the past decades, the opportunities to apply these techniques are becoming limited. The feasibility of applying these techniques -- either fencing or herding -- on allotments containing many fragmented riparian-wetland areas is also questionable. Removing livestock from these areas when predetermined grazing utilization thresholds have been met has been somewhat successful on some allotments, but there is still the problem of leaving the livestock on the remainder of the allotment for the rest of the grazing season.

The use of riparian-wetland areas by other ungulates, in conjunction with livestock, makes the problems all the more complex. Wild horses and burros, in particular, present a difficult management problem. These animals also find most riparian-wetland areas attractive and may overuse the vegetation even in the absence of livestock.

Yet another factor making riparian-wetland management difficult is the fact that on many allotments the majority of the riparian-wetland areas are privately owned and these areas are often intermingled with small areas of BLM lands. The ability to enhance and sustain healthy riparian-wetland areas on public lands requires extensive cooperation with all land owners and other interests. Opportunities for success in these areas may be limited.

3.4.3 Water Quality

Administration

Standards for water quality established by the State of California are identified in each of the nine (9) Water Quality Control Plans, commonly called "Basin Plans," that apply to each of the 9 Regional Water Quality Control Boards in the state. The regions applicable to this EIS include the North Coast Region (1), San Francisco Bay Region (2), Central Coast Region (3) Central Valley Region (5), and part of the Lahontan Region (6). See Map 5 for the location of the Regions. The standards for each region are identified as water quality objectives and non-degradation standards in these Basin Plans. The numerical standards are based upon U.S. EPA’s handbook on water quality standards and identify general requirements based on land use activities and their relationship to the beneficial uses of the particular water bodies involved.[8] (As a rule, the numerical standards are focused on point pollution activities, and the non-degradation standards are more applicable to non-point activities such as grazing.)

California’s Water Resources Control Board publishes a California Water Quality Assessment, commonly called a 305(b) Report, which serves as a catalog of the State’s water bodies and their quality condition. The latest publication was completed in 1996. This publication lists known impaired water bodies and known or suspected probable causes for point and non-point source pollution. The assessment is not exhaustive, nor is it site specific, but rather, it serves as an indicator of which water bodies are impaired, the impairment problem and the probable cause of the impairment.

The 1996 Water Quality Assessment (305(b)) Report listed 20 water bodies in California as being, or suspected of being, impaired by grazing, or that one of the sources of pollution is from rangelands within the watershed. The magnitude of impact or specific water quality problems related to livestock grazing on public rangelands with the watershed of the

[8] As defined within the Basin Plans, Water Quality Standards consist of both the designated "beneficial uses" and the water quality "objectives" needed to protect those beneficial uses. The standards are only one component of a Basin Plan. The entire Basin Plan, not just the standards, is the instrument that ensures water quality suitable for beneficial uses. Taken out of context of the Basin Plan, the water quality standards are often unachievable, and may raise unrealistic expectations.

respective water bodies is not identified in this report. Some additional data is available at the Regional Water Quality Control Board Offices, but site-specific information regarding non-point source pollution from livestock grazing on public lands has not been obtained.

In 1995 the State Water Resources Control Board approved a California Rangeland Water Quality Management Plan, which includes best management practices (BMPs) applicable to grazing activities on privately-owned rangeland throughout the state. Appendix 8 identifies the BMPs contained in the plan. The California State Director for BLM and the California State Water Resources Control Board have developed a Memorandum of Understanding regarding the management of non-point pollution sources on public lands administered by BLM. This agreement calls for the development of a water quality plan by BLM, part of which is to include best management practices for livestock grazing as well as other land uses. This plan is currently being drafted (the draft of the proposed livestock grazing section is in Appendix 10). When the plan is finalized and accepted by the State and U.S. EPA, the State will then enter into a Management Agency Agreement with BLM, formally recognizing BLM as a Designated Management Agency to manage non-point source water quality pollution activities under the Clean Water Act on public lands.

The State of Nevada's Division of Environmental Protection, Bureau of Water Quality Planning establishes and administers water quality standards for lands within Nevada. The water quality standards for the State are identified as Water Quality Regulations, last revised in November 1995. In addition the State Division of Environmental Protection and the Districts within the Nevada Division of Conservation have developed a Handbook of Best Management Practices (BMPs). This handbook identifies suggested BMPs to be used for land use activities, including livestock grazing. Appendix 9 identifies the BMPs suggested for livestock grazing in the Nevada handbook.

An agreement has not yet been developed between the Nevada Division Of Environmental Protection and the California State Director of BLM involving procedures for obtaining designated management status for those lands administered in Nevada by the California State Director.

Current conditions

Grazing activities, if excessive, may contribute sediment, nutrients and pathogens into the water supply that adversely impact water quality and impair beneficial uses. Soil erosion is generally considered the primary cause of lowered water quality on rangelands, and is caused by the removal of vegetative cover and trampling of surface soils both near and up-slope of water bodies. Nutrients leached from manure may be introduced into surface water in areas where livestock congregate for water, feed, salt, and shade. Localized contamination by pathogens in surface and ground water may result from livestock, particularly where congregated near surface water bodies. Fecal coliform levels are the primary indicator of this contamination. Water temperatures (both summer and winter) are also affected by removal of vegetative cover. In the summer, this temperature increase will result in a reduced dissolved oxygen level. In the winter, temperature decreases will result in more freezing of the channels. Additionally, excessive grazing has altered channel configuration, and lowered water tables.

In 1979, California BLM, under the requirements of Section 208 of the Clean Water Act, conducted a water quality problem assessment and published a report. Thirteen existing, suspected, or potential problems were identified that were associated with livestock grazing. The primary concerns were with sedimentation, temperature, dissolved oxygen, pathogens, and mechanical habitat alteration. A query of the involved Field Offices in 1996 indicated that most non-source point water quality problems are now general in nature, and that some of the specific problems originally identified in the report have been resolved.

The State's Basin Plans have not identified specific non-compliance from BLM's grazing management activities and there have been no other identification of violations in complying with the Federal Clean Water Act or State Porter-Cologne Act resulting from BLM grazing management. The lack of known livestock associated water quality problems does not mean that they do not exist on Public Lands. Until recently the emphasis of most water quality studies has been on point sources of pollution, and there is, therefore, not yet a complete assessment of non-point source problems, particularly those related to livestock grazing on public lands. The concern by the public and resource managers that livestock grazing is an important non-point source of pollution has escalated in recent years; it is expected that more intensive assessments will be made to determine the locations and magnitude of any problems.

Currently there are several water bodies or portions of water bodies where livestock grazing activities on public rangelands are at least one of several suspected causes of non-point source pollution contributing towards impairment of the beneficial uses of the water. Some of these are identified in both the Basin Plans and the State-wide Assessment for California. As mentioned above, there is little information to make conclusions about the magnitude of the problem, about how much is due to the use of the public lands or stems from other ownerships, or about what specific remedies are needed. Most of the livestock-related impairment identified in these documents occurs along the eastern slope of the Sierra Nevada and in the Great Basin ecoregion.

There are also some areas within central California where public land livestock grazing activities are suspected to contribute to the acceleration of impairment, for example the introduction of selenium in some watersheds along the western portions of the San Joaquin Valley, and problems in the upper watershed areas of the Pit River. However, specifics regarding the cause or suggested remedies in these areas have yet to be determined.

There has been some concern expressed too, at least in California, that livestock watering areas, particularly impoundments and watering facilities, may not meet standards for municipal supply. By State resolution, this beneficial use is applied to all waters of the State unless specifically exempted. California's State Water Resources Control Board, however, through Resolution No. 88-63 has excepted impoundments (stock ponds) and troughs that have a sustained yield of less than 200 gallons per day from meeting numerical drinking water requirements. The State of Nevada has a similar exception. These exceptions should alleviate some of the concern related to complying with requirements, particularly for most livestock watering facilities. There may be some instances, however, where influences from livestock grazing activities within a watershed could threaten drinking water or recreational swimming qualities that are beneficial uses of a water body. To date, conformance with and enforcement of these standards for livestock grazing has not been a high concern and livestock grazing, being a non-point source of pollution, is not usually required to meet numerical drinking water standards unless there is a concern that a particular water body (impacted by grazing) will not meet pre-treatment standards for potable use.

Improvement methods

In some areas where livestock grazing was known to have contributed to impairment, remedies were put into place to eliminate or minimize the impairment. Some examples of remedies include the exclusion of concentrated livestock use at or near water bodies, either total exclusion through fencing or herding, or re-distribution of grazing activities. Measures have also been taken to reduce grazing levels in some of these areas, either through reducing the number of grazing animals, shortening the season, and/or changing the period of grazing to lessen the probability of impairment. Most current management measures designed to generally enhance riparian and wetland conditions also help improve water quality.

3.5 WILDLIFE

3.5.1 Wildlife Communities

Livestock grazing occurs in a variety of wildlife habitats on BLM lands in California that include many of the natural vegetation types occurring within the three Floristic Provinces of California: the California Floristic Province, the Great Basin Province, and the Desert Province (Hickman 1993; see Map 4). This EIS evaluates grazing management in the California and Great Basin Provinces, where livestock grazing in wildlife habitats on BLM lands predominately occurs on annual grasslands in the coastal, Great Valley, and Sierran and Cascade foothill regions, and in the sagebrush steppe communities of the eastern Sierra Nevada and intermountain regions.

Within the California Floristic and Great Basin provinces, livestock grazing on BLM lands occurs within 16 habitat types as described by Mayer and Laudenslayer (1988) for the California Wildlife Habitat Relationships System (CWHR). For analysis, these 16 habitats are combined into five vegetation and wildlife habitats: Annual grasslands, Pinyon-juniper, Chaparral, Sagebrush steppe, and Wetland-riparian. The acreage estimates of these vegetation types on BLM lands in California is shown in Table 3.5.1. Vegetative descriptions of these habitats are found in the previous vegetation section.

These habitat types, as described by Mayer and Laudenslayer (1988), serve as a habitat classification system to predict and evaluate wildlife use on a habitat basis. The relationships between 650 species of wildlife and their habitats have been described and used to develop the California Wildlife Habitat Relationships System. This system uses habitat models to rate the species' preference for a habitat and successional stage based on research, published literature, and expert opinion. A species preference for each habitat is rated as optimum, suitable, marginal, or not used for life sustaining activities, such as reproduction, foraging, and cover (Airola 1988). Based on this information, these habitat types support numerous wildlife species that would be expected to occur on BLM lands within the EIS area (Table 3.5.1(a)).

Table 3.5.1: Acres of CWHR Habitat Types on BLM Lands in California. (from FRRAP, 1988)

Habitat Type	Acres (state-wide, in 1000s)
Annual Grasslands	
Annual Grasslands	350
Alkali Desert Scrub	586
Valley Foothill Hardwood (Oak Woodland)	411
Chaparral (Chamise-Redshank Chaparral, mixed Chaparral)	687
Sagebrush Steppe	
Sagebrush, Bitterbrush, Low Sage, Aspen	2,887
Pinyon-Juniper, and Juniper	766
Wetland-Riparian	
Valley-Foothill Riparian and Montane Riparian	2
Wet Meadow and Freshwater Emergent Wetland	68

TABLE 3.5.1(a): Number of Species expected to occur in each CWHR Habitat Type *

Habitat Type	Number of Amphibians	Number of Birds	Number of Mammals #	Number of Reptiles
Annual Grassland	10	101	43	23
Alkali Desert Scrub	4	87	36	20
Oak Woodlands	18	137	40	28
Coastal Scrub, Chamise-Redshank Chaparral, Mixed Chaparral	17	129	64	30
Sagebrush, Bitterbrush, Low Sage	3	84	55	24
Pinyon-Juniper, Juniper	3	135	52	30
Aspen	1	80	39	3

TABLE 3.5.1(a): Number of Species expected to occur in each CWHR Habitat Type *				
Habitat Type	Number of Amphibians	Number of Birds	Number of Mammals #	Number of Reptiles
Valley-Foothill Riparian, Montane Riparian, Wet Meadow	27	239	73	28

* These are regularly occurring species that are expected to occur if all habitat components (food, water, cover, and habitat patch size) and features (eg. cliffs, burrows, water, trees, cavities, snags, etc.) were present in the BLM habitats on public lands within the EIS area.

\# Excludes bats which may fly over and feed aerially.

The numbers of wildlife species that occur in Table 3.5.1(a) reflect the large geographical scale of the EIS area and the combination of CWHR habitats listed. Thus, the numbers of species that may occur in these habitats on a particular parcel of BLM land would be less than predicted by the CWHR. However, the table reflects the relative richness of wildlife species that may occur among the listed habitat types.

3.5.2 Big Game

BLM lands in California support populations of mule deer, pronghorn, tule and Rocky Mountain elk, and big horn sheep. The BLM's 1993 Public Land Statistics estimated that over 13,427,000 acres of BLM lands in California support big game animals. It is estimated that BLM lands provide habitat for 101,000 mule deer, 6,500 pronghorn, 1,000 elk and 4,200 big horn sheep in the state (including the California Desert District).

Mule Deer. The Columbian black-tailed deer (*Odocoileus hemoines columbianus*) and California mule deer (*Odocoileus hemoines californicus*) are the two subspecies that occur on BLM lands in the EIS area (Walmo 1981). Columbian mule deer occur in the coastal and northern California ranges, while the California mule deer occur in the Sierra Nevada and Tehachapi ranges over to the central coast.

Mule deer are most commonly associated with shrub and woodland habitats. In the coastal region of California, the preferred habitats include oak woodlands, chaparral, and riparian habitats, and the animals tend to be non-migratory. In the Great Basin, Sierra Nevada, and Cascade mountains, the preferred habitats include oak woodlands, forest communities, aspen, montane riparian, and meadows in the summer. Winter ranges occur in sagebrush and bitterbrush habitats on the east slopes and in chaparral, oak woodlands, riparian, and lower elevation hardwood conifer habitats on the west slopes when heavy snows force migrations to lower elevations.

Food and cover requirements vary greatly between the regions of California. Stomach analysis of coastal animals show that they feed on browse, including acorns, consistently throughout the year for about 48% of their diets. Forbs made up about 28% of the diet, mostly consumed in the summer; grass and grasslike plants were eaten in the cooler months for about 24% of the diet (Walmo 1981). In the Great Basin region, forbs and grasses and grasslike plants contribute a significant portion of deer spring summer diets, while sagebrush, bitterbrush and service berry make up 95% percent of winter diets.

The relationship between mule deer and livestock grazing in California has been developing since the late 1700's when cattle and sheep were introduced with the development of the Spanish missions along the California coast (Burcham 1981). Cattle reached the north coast and Lassen County in the 1850's. Burcham (1981) reported cattle numbers of 253,599 head in 1850, increasing to 1,107,646 in 1950. For the same period, sheep numbers were 17,574 in 1850 and 2,056,663 in 1950, with a peak of over 4 million head in the 1880's. Livestock numbers peaked in the 1870's, but then drought conditions and hard winters reduced numbers in the 1880's and 1890's. The overgrazing of the California rangelands and mountains in the 1870's resulted in changes in shrub and forest vegetation that may have ultimately increased the numbers of deer in the state (CDFG 1991).

The immediate effect of the heavy grazing of deer habitats and unregulated hunting was a decline of mule deer numbers in the late nineteenth century. However, during the period of 1900 to 1960, deer numbers in California increased with estimates beginning in 1932 at just under 500,000 deer to over 2,000,000 in 1960. This increase is attributed to several factors: vegetation changes to more shrubby types as a result of overgrazing; more shrub habitats resulting from logging activities that opened the closed forest canopies; increases in fires in forest and chaparral communities that promoted sprouting of young shoots and more open habitats; and then regulated hunting and enforcement (CDFG 1991).

Since the 1960's there has been a decline in deer numbers not only in California, but across the western United States. Efforts have been made to relate this decline to factors such as habitat deterioration, predation, competition with livestock, habitat loss due to human development and hunting. However, none of these factors, individually or in combination, fully explains the population declines in all areas in which they occurred (CDFG 1991).

Since the 1970's, California's deer numbers have remained relatively stable at around 700,000 head. Increases in deer numbers in the state appears to be primarily influenced by the quantity and quality of habitat available (CDFG 1991).

Elk. Burcham (1981) noted that the early California settlers recorded elk as common to abundant in the coastal areas from Monterey Bay north to San Francisco, and throughout the Central Valley. They preferred the moister habitats in open country, occupying principally the margins of the marsh-grass community and areas that were not well drained. Herds of 1,000 to 2,000 animals were recorded, with early explorers estimating elk numbers above 500,000. The number of tule elk declined steeply in the mid-1800's due to market hunting and land use conversion to intensive agriculture. By the late 1860's, the elk of the central valley were reduced to one small herd in western Kern County (CDFG 1994a).

Changes in elk habitat through the conversion of native perennial grasslands to annual grasslands have been attributed to livestock grazing. This grassland conversion resulted in the loss of important forage plants used by elk in the summer and fall months (CDFG 1994a). However, it is unclear how this change may limit current population levels.

The north coast of California is currently populated by 3,500 head of Roosevelt elk (*Cervus elaphus roosevelti*) in the coastal regions of Del Norte, Humboldt, and Mendocino Counties. BLM lands that provide habitat for this species are not grazed by livestock.

Tule elk (*Cervus elaphus nannoides*) occur on BLM lands in San Luis Obispo, Lake, and Inyo Counties where they were transplanted from the remaining herd located at Tupman, Kern County in the San Joaquin Valley. Transplantation of tule elk has been a successful conservation program that has increased state populations from 500 animals in three herds in 1971, to over 2,700 animals in 22 herds distributed around the state in 1994 (CDFG 1994a). Approximately one-half of California's tule elk occur on local, State, and Federal public lands.

Tule elk inhabit chamise chaparral, mixed chaparral, and oak woodlands/savannah in the Cache Creek herd in Lake County; chamise chaparral, mixed chaparral, juniper-oak woodlands, oak savannah, and annual grasslands in the La Panza herd in San Luis Obispo County; and in alkali desert scrub and desert riparian habitats in the Owens Valley. Livestock grazing conflicts are considered negligible in these herds. Food habit studies suggest no direct competition between cattle and elk because the forage species are widespread and not in short supply (CDFG 1994a). The livestock industry has expressed concern regarding fence damage from some populations.

In Modoc County, three herds of elk are expanding and will probably include the use of BLM habitats in the near future. These populations, numbering about 200 animals in total, may occasionally inhabit BLM grazing allotments, in which adequate forage and cover will be a concern.

Pronghorn. Pronghorn (commonly called antelope) were originally distributed throughout the lower elevations of California from the outer borders of the marsh-grass community upward into the lower limits of the foothill woodland. They were noted by the early Californian anglo settlers and Native Americans as plentiful from San Diego through the coastal valleys, the Central Valley, and north to the vicinity of Klammath Lake. They were most abundant in the San Joaquin Valley, where they formed herds of up to two or three thousand animals (Burcham 1981) with densities reported to be greater than any area west of the Mississippi. The twenty years following the gold rush of 1848 saw great declines in pronghorn numbers due to market hunting, poaching, livestock competition, land use, agriculture, and other disturbances brought on by Anglo-American settlers (CDFG 1994b).

Since the 1940's, over 1,000 pronghorn antelope have been transplanted back to former historic ranges within California. Today, pronghorn remain abundant in the Modoc region of northeastern California, and they have been reintroduced into the coastal counties of San Luis Obispo, Monterey, and San Benito and into Mono County. Sizeable herds occur on BLM lands in nearly all of these areas, with over 66 percent of pronghorn range occurring on BLM and Forest Service public lands where livestock grazing is the primary land use (CDFG 1994b).

Increased agricultural production (alfalfa and grain crops), water development on public land, and more ecologically sound livestock grazing (now less destructive to wildlands in terms of over grazing and damage to vegetation) have likely been a great benefit to pronghorn antelope in California because of the increased availability of native forage, as well as high-quality forage crops grown for livestock on private lands (CDFG 1994b).

3.5.3 Upland Game

BLM lands in California and Nevada provide habitats for a variety of upland, small game and waterfowl species. The upland species that occur on grazed rangelands include several species of rabbits and hares, California quail, mountain quail, chukar, sage grouse, mourning doves, wild turkey, and ring-necked pheasant. The variety of habitats used by these species include all of the non-forested rangeland habitats in the EIS area, including grasslands, shrublands, and woodlands. Populations of these species have fluctuated with rainfall and other climatic patterns, with no consistent long term trend. Hunter harvest of quail, chuckar partridge, sage grouse, jack rabbits, and cottontail rabbits, used as a measure of upland game populations, have also fluctuated between 1987 and 1996 with 44% of the years showing increases in harvest and 56% of the years showing decreases in harvest between consecutive years. Recently, sage grouse populations have increased as riparian conditions have improved on BLM lands in Mono County (CDFG, pers. comm.). Livestock grazing commonly occurs within the habitats of these animals.

3.5.4 Riparian, Wetland, and Aquatic Communities

Riparian Communities. Riparian habitats represent the most important wildlife habitats on California rangelands. More than any other western habitat, riparian woodlands are centers of high diversity and abundance of neotropical migratory birds (Bock et al. 1993). Less than 1% of the western United States contains riparian vegetation, yet more species use them for breeding than any other habitat type in North America (Douglas et al. 1992). The presence or absence of many neotropical migrant species in riparian habitats is directly tied to the complexity and density of vegetation structure, especially in the shrub and herbaceous layers (Dopkin 1994). At least twice as many birds may be found breeding in riparian areas than in adjacent non-riparian areas (Stevens et al. 1977), and many species of birds breed exclusively in riparian areas and are not found at all in adjacent habitats (Hurst et al. 1980). For foraging, these areas provide a complex of foliage, bark and ground substrates. These habitats provide feeding sites during migration; and during the summer, the low elevation riparian habitats provide the only lush, insect rich forest habitat available.

Conservation of neotropical migratory land birds in the western United States depends greatly upon the protection and restoration of riparian woodlands.

Wetland Communities. California's wetland habitats support winter populations of 8 to 10 million ducks, geese, swans, and other birds -- about 60% of the entire Pacific Flyway population. Today's populations are estimated to be mere remnants of the hundreds of millions of waterfowl that once used millions of acres of wetlands in California. Loss of habitat due to agriculture and urban conversion has been the primary cause of populations declining (FRRAP 1988).

The location of BLM lands in California in the upland portions of landscapes limits the amount of wetland bird habitat on public lands. However, there are 129,257 acres of BLM lands (BLM 1989) supporting wetland species, and some special management areas managed by BLM make important contributions to conservation of wetland wildlife. Such areas include the Cosumnes River Preserve, BLM lands along the Sacramento River, and the Mattole River. In addition, there are numerous freshwater wetlands, alkali lakes, rivers and streams, flood control and domestic water reservoirs, stockwater reservoirs, and constructed wetlands that occur on BLM lands.

BLM wetlands have not reached their potential to support waterfowl and other wetland wildlife. Livestock grazing has contributed to this situation, but management plans and grazing management systems are being implemented to improve these habitats.

Fisheries. BLM lands in California include 3,500 miles of streams and 62,000 acres of lake and pond surface waters. There are 132 identified fish species in the state, of which 116 are native (67 endemic to California; BLM 1995). In northwest Nevada, there are eight native species and two endemic species. There are ten native species listed as threatened or endangered, and 35 listed as California species of special concern. Over 50 percent of the native species are either at risk of extinction or in decline. Although there are few pristine aquatic systems remaining in the state, there are several with intact native fish communities that are managed by BLM in California.

The condition of BLM aquatic habitats has not been rigorously inventoried and classified, but has been evaluated through the process of proper functioning condition assessments. In 1995, BLM determined that, within the EIS area, 319 miles (28%) of stream habitat were in "proper functioning condition" to provide the habitat necessary for fish production, 807 miles (69%) were "functional at risk" due to degradation, and 37 miles (3%) were "non functional" and do not provide the characteristics necessary for fish production and survival (see Table 3.4.1(a) on page 40). This analysis did not, however, determine whether livestock grazing or other factors were responsible for areas not being in proper functioning condition. The BLM is working to complete proper functioning condition determinations for all riparian habitats with fisheries by the end of 1997. Livestock grazing is estimated to occur on 33 percent of the BLM managed stream miles in the state.

3.6 SPECIAL STATUS SPECIES

Occurrence of special status species on BLM grazing allotments within the project area varies significantly by species. In some cases, the species have been recorded within Field Office jurisdictional boundaries, but they are not known to occur on any grazing allotments. In other cases, the species are known to make year-round use of the grazed habitats. Other degrees of overlap and use of the grazing allotments include seasonal use, selective use of a specific habitat component (e.g. riparian), and occasional or incidental use by wandering individuals.

Appendix 11 shows the 159 special status plant species with recorded occurrences on BLM lands within the project area. Thirteen of these species are federally listed (11 endangered, 3 threatened) and 23 are state-listed (15 endangered, 3 threatened, and 9 rare).

Appendix 12 shows the 43 special status animal species that are known or suspected to occur on BLM lands within the project area. Thirty-one of these species are federally listed (20 endangered, 11 threatened) and 23 are state-listed (19 endangered, 4 threatened).

Both appendices show the species, the status, the Field Office jurisdiction within which it occurs, and the effects of grazing upon the species. Where there is only minor overlap between a species occurrence and a BLM grazing allotment, that is also noted in the appendix.

3.7 WILD HORSES and BURROS

With the passage of the Wild Horse and Burro Act (Public Law 92-195) in 1971, Congress declared that wild horses and burros (*Equus* spp.) are to be considered an integral part of the natural system of the public lands. Among other things, the Act requires BLM to maintain a current inventory of wild and free-roaming horses and burros on public lands and to determine their appropriate management levels (AMLs). The appropriate management level of a given area is one that will preserve and maintain a thriving natural ecological balance and multiple-use relationship in that area.

When BLM determines that an overpopulation of wild horses and burros exists on a given area and that action is necessary to remove excess animals, it must remove the excess animals to achieve appropriate management levels. Generally, BLM monitors environmental indicators and considers this information along with information that it has gathered about impacts caused by other use(s) (principally livestock grazing) and with available information concerning wild horse and burro demographics. These data are periodically analyzed to determine what constitutes an appropriate management level for a given area for a given period. Following this determination, BLM periodically gathers and removes sufficient animals to approximate the current AML for that herd management area.

To administer the Act on public lands,[9] BLM California has designated 14 Herd Management Areas within the EIS analysis area. Map 6 depicts their general location. Each Herd Management Area is managed "on-the-ground" under the auspices of a Herd Management Area Plan, except for the Montgomery Wild Horse Territory which is managed through a Coordinated Resource Plan under the lead of the Inyo National Forest. Information about these management areas pertinent to this EIS is shown in Table 3.7, below.

TABLE 3.7: Herd Management Area (HMA) Information for HMA's in EIS Analysis Area

HMA NAME	SIZE (Acres BLM, and Other)	GENERAL LOCATION	AMLs[a] (Number of Animals)	LAST CENSUS (Federal Fiscal Year)	ESTIMATED CURRENT POPULATION[b]
Fort Sage	14,695	NE California	38* horses	1994	15 horses
Twin Peaks	797,927	NE California and NW Nevada	725* horses 132* burros	1994	1071 horses 123 burros 15 mules
Ravendale	27,560	NE California	15* horses	1996	47 horses
Red Rock Lakes	16,895	NE California	21* horses	1993	26 horses

[9] The Wild Horse and Burro Act also applies to lands in the National Forest system.

TABLE 3.7: Herd Management Area (HMA) Information for HMA's in EIS Analysis Area					
Devil's Garden[c]	236,000	NE California	305* horses	1996	280 horses
Coppersmith	70,760	NE California and NW Nevada	63 horses	1996	91 horses
Buckhorn	65,640	NE California and NW Nevada	72 horses	1996	81 horses
Fox Hog	119,280	NW Nevada	63* horses	1996	314 horses
High Rock	115,100	NW Nevada	85* horses	1994	168 horses
Wall Canyon	49,277	NW Nevada	20 horses	1994	35 horses
Nut Mountain	40,680	NW Nevada	43 horses	1994	52 horses
Bitner	50,660	NW Nevada	20 horses	1994	27 horses
Massacre Lakes	40,730	NW Nevada	15* horses	1989	41 horses
Carter Reservoir	23,200	NW Nevada and NE California	25* horses	1989	55 horses
Montgomery Pass Wild Horse Territory[d]	207,921	Central East California and Central West Nevada	184 horses	1996[e]	149 horses
15 Herds	1,876,325 Acres		1694 horses 132 burros		2452 horses 123 burros 15 mules

Footnotes to Table 3.7

a. With the exception of the Montgomery Pass Wild Horse Territory (see footnotes d and e), the appropriate management levels listed in this column are the mid-points of population ranges that the herds are managed within, for each Herd Management Area, in accordance with a method known as "Structured Herd Management." Populations designated with an asterisk were established in the respective land use plan and based on the forage allocations contained in said plans. The other AML's were designated following a determination based on analysis of monitoring information that occurred subsequent to the approval of the land use plan.

b. Except for those HMA's that were censused in 1996, current population estimates are based upon a formula that estimates a herd's population increase since the last census. This formula accounts for the following factors: recruitment rates expected in the years after a gather (accounting for an increased conception rate in the year following the removal, carrying through term, and foal survival); age structure of the herd following a removal; and mortality. Generally, over a period of 4 years, this rate of increase averages 17 percent. The Montgomery Pass Wild Horse Territory demographics have been and are being studied by Dr. John Turner (see footnote e).

c. This Herd Management area occurs principally on the Modoc National Forest (227,500 acres MNF and private lands occurring in the MNF, and 8500 acres BLM and private lands occurring in the Alturas Field Office jurisdiction, BLM) and is managed in cooperation with the Modoc National Forest.

d. The Montgomery Pass Wild Horse Territory is managed through a Coordinated Resource Plan under the lead of the Inyo National Forest. It includes lands administered by their Mono Lake Ranger District, the Toiyabe National Forest - Bridgeport Ranger District, the Carson City District BLM (Nevada), the Bishop Field Office BLM (California), and State lands (California) and private lands.

e. This figure is based on a fall, 1996, inventory by Dr. John Turner. The Montgomery Pass Wild Horse Herd has not been gathered since 1984. It is the only naturally regulated population of wild horses in the United States. The population trend of this herd has been studied since 1986 and is down. Spring and summer mountain lion predation is a significant factor affecting the demographics of this herd. (Dr. John Turner, Professor of Physiology, Medical College of Ohio, personal communication, November 4, 1996).

All of the wild horses and burros occur in remote areas of the sagebrush steppe (see Section 3.3.2 for a description). A review of the pertinent Herd Management Area plans indicates that land condition in the wild horse and burro HMAs generally is fair (based upon NRCS's poor, fair, good, excellent scale, as explained in Section 3.3.3, Upland Conditions and Trends), with some having relatively more poor condition land, and others having more good condition land. All support a host of wildlife species typical to the Great Basin, including deer and pronghorn and numerous non-game species; however, "top-of-the-food-chain" predators such as mountain lions, that used to occur in greater abundance prior to settlement by the pioneers in the 1800's, are scarce. One herd management area supports bighorn sheep. Most have riparian areas, some to a greater extent than others. All support permitted livestock grazing - principally cattle with some sheep use. Most occur on lands in Wilderness Study Area status. Some have significant cultural resources.

With the exception of the Montgomery Wild Horse Territory, which has a naturally regulated population, all of the populations are managed under the principals of Structured Herd Management. Under this technique, BLM periodically gathers the entire population of a herd (or, as close to the entire population as practicable) and specific animals from the gathered herds are placed back out on their range while the remainder are put into the BLM's wild horse and burro adoption program. In this way, the age structure, sex-ratio, and animal characteristics (color and height) of each herd are purposefully managed by BLM. The effects of this technique on the social interactions in and among the herds is not known; however, it does not seem to significantly affect the viability of the populations.

Livestock grazing occurs within all Herd Management Areas. There is considerable overlap of forage and habitat space between wild horses and burros and livestock. This overlap results from the similarities in the forage preferences between these ungulates, mainly for grasses and forbs. Usually the overlap is greater between cattle and wild horses and burros than with sheep, but there are exceptions depending upon the time of year used by livestock and what is available on the rangelands. Much of the time, these animals also use the same locations for watering and shelter or shade. However, wild horses tend not to use canyon bottoms or areas where their ability to spot predators might be limited. They usually limit their use of these areas to watering or for access to other more open areas. Due to the variability in terrain, vegetative communities, and other features, as well as the population and distribution of wild horses and burros, the areas and magnitude of overlap is usually quite varied and complex within the Herd Management Areas. In most Herd Management Areas, the overlap does not necessarily exist over the entire unit, but tends to be concentrated in specific areas. Of particular concern because of this overlap is the amount of degradation of riparian-wetland areas that is attributable to wild horses and burros. In some areas, livestock are removed from riparian areas, and wild horses and burros then move in, thus giving the areas no rest.

In order to determine the size of, and manage for, viable wild horse and burro populations in these Herd Management Areas, consideration needs to be given to the prudent allocation of forage available for both wild horses and burros, and livestock. Policies direct that the allocations are to be made based on the monitoring of forage use between the different animal species, conditions of the resources, requirements for sustaining viable wild horse and burro populations, and the proportions to be made or other previous commitments made in allocating forage between all of the competing ungulates that use the rangelands, including wildlife species such as deer, elk, and pronghorn. Although these allocations have been made in the past, the methods used and rationale for the allocations are often questioned by advocates for the different competing species, be they wild horses and burros, livestock, and/or wildlife.

Determinations of how much of the forage is consumed and needed by each type of animal and how much should be allocated among the competing types of animals, continues to be highly controversial and continually challenged. There needs to be improvement in developing better scientific methods for determining the forage use and needs of the animals. There needs to be agreement and clear understanding (usually reflected in land use plans) of what the appropriate wild horse and burro population levels are for any given Herd Management Area. And there needs to be a clear understanding of what proportion of the forage is to be allocated to livestock and other competing animal populations.

Range improvement facilities developed in the past, sometimes watering facilities, but particularly fences for controlling livestock, have not always been designed to consider the needs of wild horses and burros. Often these facilities interfere with the natural habits of the wild horses and burros, causing disruptions in movement across their range, population levels and dynamics. Likewise, wild horses and burros often cause damage to these facilities, requiring continuous maintenance and repair.

3.8 RECREATION

The public lands of California and Northwestern Nevada, with their tremendous variety of features and their location within a few hours of large population centers and major airports, offer a wide variety of recreational opportunities. Recreational use of the lands managed by BLM continues to grow at a phenomenal rate, as the population of California grows and the area grows as a destination for in-state, out-of-state, and foreign visitors. The 5.1 million acres of public lands covered by this study contain 13 recreation rivers, 32 developed campgrounds, dozens of trails, and untold opportunities for semi-primitive outings in open, unspoiled country.

Examples of recreational opportunities in the northwest part of the state include beaches and rugged mountains, offering equestrian, backpacking, and OHV opportunities. People watch wildlife such as sea lions and whales off-shore and Roosevelt elk in the meadows. Inland are OHV opportunities at South Cow Mountain, nature trails, and the Cache Creek Recreation Lands. Wildflowers are abundant, or a person can try to identify any of the 200-plus varieties of mushrooms that grow at Mad River Slough. The Upper Klamath, Trinity and Eel Rivers are home to salmon and steelhead, while the fierce rapids and calmer waters delight rafters.

Northern California and northwestern Nevada have thousands of sagebrush-covered acres with wild horses and pronghorn, and excellent hunting for big game and waterfowl. The Bizz Johnson trail is used by hikers and bikers in the summer and by skiers in the winter. Water sports and fishing are enjoyed at Eagle Lake. Prospecting for jasper and petrified wood in High Rock Canyon or exploring the Lassen-Applegate emigrant trail are also popular. The Barrel Springs and Buckhorn Canyon Back Country Byways provide routes for those who really want to explore the area.

Central California and the Eastern Sierra similarly have a myriad of recreational opportunities. Sightseers tour the Alabama Hills, where countless film classics were made. There are volcanic cinder cones to explore, miles of streams to fish, and trails to hike, mountain bike, or ride a horse or OHV. The Pacific Crest Trail wanders across BLM lands, as well as National Forests and National Parks. The Carrizo Plain, the state’s largest nature preserve, and part of the Pacific Flyway, is a bird-watchers’ paradise. The canyons of the Tuolumne, Merced, Yuba, and American Rivers attract rafters, kayakers, fishermen, and others, as well as people still looking for gold in the heart of the Mother Lode country.

In Fiscal Year 96 (October 1, 1995 to September 30, 1996), there were about 3.75 million visits to these public lands (ranging from an hour to a couple of weeks), totalling more than 3.04 million visitor days (12 hours = 1 visitor day), and contributing an estimated $200 million to the local economies. Most of the users of the public lands -- from fishermen to sightseers, OHV users to bird watchers -- depend upon a properly functioning ecosystem to provide them with the recreational opportunity they desire.

Grazing provides both positive and negative impacts to recreational use of the public lands. Some negative impacts are degradation of the environment in some areas, especially impacts to riparian areas and water quality, and the visual intrusion of seeing livestock in primitive areas where people expect a natural environment. Positive impacts are the visual impacts for those (especially foreign tourists) who see cattle as a bit of the "wild west." There are also a growing number of recreationists who come to partake of the "city slicker" type of cattle and horse drives increasingly being offered on public lands.

There are also impacts to the health of the land from recreational use. These have not been systematically inventoried and totalled, but include in some locations: poorly constructed or designed roads, OHV routes, and equestrian and hiking trails that result in excessive erosion, or go through sensitive wet meadows or riparian areas; trampling of riparian vegetation by campers and fishermen; and intentional vandalism of cultural sites, range improvements, signs, etc.

3.9 WILDERNESS

Within the EIS area, BLM currently manages eleven wilderness areas totaling 162,500 acres. Seven of these, totaling over 110,000 acres, are grazed. BLM also manages 77 Wilderness Study Areas (WSAs) totaling approximately 1,197,000 acres. Sixty-two (62) of these, totaling a bit over 1,175,000 acres, are currently grazed. The wilderness areas or WSAs which are either grazed or permitted for livestock use are found in Appendix 13.

The authority for managing wilderness areas is found in the 1964 Wilderness Act, the Federal Land Policy and Management Act of 1976 (FLPMA), and the Act establishing the specific area as wilderness. These Acts generally direct BLM to manage wilderness areas so their natural condition is preserved and the human influences in the area are substantially unnoticeable. As defined in the Wilderness Act, these areas must be at least 5,000 acres or of sufficient management size, appear to be affected primarily by the forces of nature, and have outstanding opportunities for solitude or a primitive and unconfined type of recreation. The overall goal for the wilderness management program is to ensure that each of these wilderness values are maintained or enhanced. To secure these values, the Wilderness Act prohibits certain uses within wilderness areas. Except as specifically provided for in the Act and subject to existing private rights, BLM cannot authorize commercial uses or the building of permanent roads in wilderness areas. Furthermore, except as necessary to meet the minimum requirements for the administration of the area for the purpose of the Wilderness Act (as defined in Section 2(a)), the Act prohibits temporary roads, use of motorized vehicles, motorized equipment or motor boats, landing of aircraft, mechanical transport, and structures or installations within any wilderness area.

The Wilderness Act provides a special provision for grazing use. Section 4(c)(4)(2) states that the grazing of livestock where established prior to the effective date of an area’s wilderness designation shall be permitted to continue subject to reasonable regulations (a more detailed explanation of this provision is found in the Congressional guidelines regarding "Grazing in National Forest Wilderness Areas" published in House Report 96-1126, dated June 24, 1980). Grazing in BLM wilderness is currently managed under 43 CFR 4100 and 43 CFR 8560. Existing grazing may include not only the utilization of forage, but also the use and maintenance of the livestock management developments and facilities associated with the grazing activity at the time of the designation and which are in compliance with an approved Allotment Management Plan. For specific grazing actions in wilderness, the BLM 8560 manual titled "Management of Designated Wilderness Areas" provides additional guidance.

The authority for managing Wilderness Study Areas (WSAs) is primarily outlined in Sections 202 and 603 of FLPMA. This Act required BLM to either inventory its public lands or determine through future land use plans which areas have wilderness values as defined in the 1964 Wilderness Act (i.e., 5,000 acres or of sufficient management size, naturalness, outstanding opportunities for solitude or a primitive and unconfined form of recreation). If areas had these values, they were designated as WSAs.

Managing WSAs is different than managing a congressionally designated wilderness. As with wilderness areas, the preservation of a WSA’s wilderness values is always paramount and is the primary consideration for evaluating any proposed action or use that may impact those values. However, BLM’s management goal for WSAs (in contrast to wilderness areas) is to ensure actions affecting WSAs do not impair their suitability for preservation as wilderness (commonly called the "non-impairment mandate"). Subject to exceptions, certain non-impairment criteria must be met before any action is approved in a WSA. For example, proposed facilities or uses must be temporary (i.e., the use does not create a surface disturbance and can be easily terminated), and they cannot constrain Congress’s prerogative regarding the area’s suitability for preservation as wilderness. As they relate to grazing, certain exceptions to this standard could apply. These could include uses or facilities which clearly protect or enhance wilderness values (e.g., the removal of man-made facilities) or actions which are considered grandfathered (e.g., grazing management as was occurring on or before the passage of FLPMA). However, even these exceptions must still be managed to prevent unnecessary or undue degradation of the public resources. BLM handbook H-8550-1 titled "Interim Management Policy for Lands under Wilderness Review" provides additional guidance for managing grazing uses within WSAs.

3.10 CULTURAL RESOURCES

Cultural resources are divided into two categories, cultural properties and traditional lifeway values. These are the material items and places, and the beliefs and behaviors, that define the culture and cultural history of a group of people. For a brief cultural history (prehistoric and historic) of the western United States, see Chapter 3 of the Draft Rangeland Reform ’94 EIS (BLM, 1994).

3.10.1 Cultural Properties

Cultural properties are physical remains of human cultures. They can be of prehistoric or historic origin. Typical examples are historic districts, sites, buildings and artifacts that are important in past and present human events. Cultural properties are managed primarily through the Section 106 (National Historic Preservation Act) compliance process. Before authorizing surface disturbance, BLM must identify cultural properties eligible for inclusion on the National Register of Historic Places and consider the effects of the proposed undertaking through the consultation process in Section 106.

Being the tangible remains of human cultures, cultural properties are subject to physical impacts from livestock grazing. In riparian zones, around springs and watering tanks, along livestock trails and fences, and in confined areas such as holding pens, livestock trampling can significantly impact and potentially destroy shallow archeological sites. The impact on riparian zones is particularly significant since cultural resources site densities tend to be higher in these areas. Not only do livestock accelerate bank erosion along streams where cultural deposits are often buried, but the depletion of ground cover through trampling and overgrazing hastens the erosion of cultural properties by wind and rainfall. Additionally, cattle rubbing against objects can destroy historic structures and rock art (BLM, 1994).

Cultural properties may also be damaged by earthmoving equipment such as bulldozers, backhoes, drills, and hand tools, or when roads, trails, and other access routes are developed, maintained, or improved to facilitate rangeland operations. The severity of effects varies with the intensity of the proposed activities. Additionally, cultural properties near rangeland activities are vulnerable to increased vandalism, theft, and impacts from vehicle use (BLM, 1994).

3.10.2 Traditional Lifeway Values

A traditional lifeway value is important for maintaining a specific group’s traditional system of religious belief, cultural practice, or social interaction. A group’s shared traditional lifeway values are abstract, nonmaterial, ascribed ideas that cannot be discovered except through discussion with members of the group. Lifeway values may or may not be closely associated with definite locations.

Native Americans

Native Americans use their local environments to gather native plants, animals, and minerals for use in religious ceremonies, rites of passage, folk medicine, subsistence, and crafts. In Native American religious practice, any environment can contain specific places that are significant for spiritual purposes. Those sacred places embodying spiritual values are often associated with indigenous rock art, rock cairns and effigy figures, spirit trails and spirit gates, caves, mountain peaks, and springs or lakes. Contemporary use areas are associated with traditional plant and mineral collection locales, vision quest sites, shrines, and traditional trails.

Federal concerns with Native American traditional lifeway values primarily respond to the American Indian Religious Freedom Act of 1978 (see Appendix 3 for a more complete list of various cultural resource laws). This act requires federal agencies to evaluate their policies and procedures, with the aim of protecting the religious freedom of Native Americans. But in compliance with several laws and executive orders, as well as a sincere desire to ensure that Native Americans can continue to practice their traditional lifeways, it is BLM policy to consult with tribal groups whenever a proposed activity on BLM land might adversely affect that group's ability to continue those traditional lifeways.

As Europeans settled California and the livestock industry has developed over the past 200 years, Native American traditional lifeway values have been considerably altered. Historically, ranching (starting with the Spanish missions) has directly conflicted with Native American traditional lifeway values; in many cases, totally destroying people's ability to practice those lifeways. Even where the traditional lifeways are being continued, grazing on public lands can interfere with those lifeways. Some examples are:

> Destruction of traditionally used resources (through vegetative treatments, overgrazing).
>
> Denial of access to traditionally used plants during the relatively short periods when they may be available or denial of access to enhance the habitat (traditionally, many areas were burned or otherwise manipulated by Native Americans to enhance propagation of certain species, etc.).
>
> Sacred sites and burials may be damaged or desecrated by livestock.
>
> Some religious practices require solitude and isolation.

Ranching Communities

Participants in traditional ranching life are carrying forward a significant part of the world's image of America and America's image of itself. Western ranching communities have traditional activities, social behaviors, and values that are part of the Nation's historic, cultural, and natural heritage. An integral part of this tradition are the traditional cultural properties that have developed over the years, including the associated landscape with its developed springs, wells, and watering tanks, fencelines, wild horse traps, corrals, ranch houses, sheep herding camps, shearing pens, loading chutes, grange halls and community centers, and one-room school houses.

This traditional western ranching culture can be traced to the 1600s in California. It involves the production of cattle and sheep, mainly through grazing and haying of forage. The identity of many small towns and communities in northern, central and eastern California continues to be associated with this tradition, and its activities, behaviors and values.

However, due to the economics of the livestock industry, many small ranching communities, or families within these small communities, are struggling to maintain their traditional lifestyle. More and more of these ranchers are working jobs off the ranch to secure greater financial stability, and support their families. The number of ranchers whose main occupation is not ranching has increased substantially over the past 20 years. Part-time ranching has become a growing part of U.S. agriculture. This rural economic diversification has enabled many ranching families to remain in ranching part time and maintain their traditional ranching lifestyle.

But at the same time, as demographics change, and more people flee the big cities to live and work in these small communities, they are bringing a different culture with different value systems into these communities, thereby introducing another element that threatens the traditional lifestyles and values of these communities.

3.11 ECONOMIC CONDITIONS

Changes in the BLM grazing program have the potential to economically affect livestock operators, local governments, and communities, as well as the expenditures of the BLM rangeland management program. The economic impact of each Standard and Guideline alternative will be analyzed for each of the entities listed above.

The economic impact variables that will be analyzed in this document are: livestock revenues and expenses and ranch permit value, state and county income, employment, government transfer payments, and California possessory interest taxes. These variables will be examined for the EIS study area and principal grazing counties. The following economic affected environment section for the Final EIS has not been changed from the draft version of the EIS.

3.11.1 The Western United States

3.11.1.1 The Western Livestock Industry

While livestock operators with permits to graze on federal land are economically important regionally and to local communities, they are only a small part of the national beef and lamb industry. There are an estimated 22,350 separate livestock operators who hold permits to graze on federal rangelands (Fowler 1993). These operators comprise 3.4% of all livestock operations in the country. Eighty-two percent of the permits are for cattle grazing and 18 percent for sheep. These and the following Western Region statistics are drawn from the 1994 Rangeland Reform EIS (RR 94; BLM 1994).

In the 11 western states, where federal rangeland is concentrated, permittees and lessees make up 22 percent of total beef producers and 19 percent of sheep producers. The permits provide about 25 percent of all forage consumed by beef cattle in a year. BLM administered land makes up about 5 percent of the overall annual feed requirements for sheep operations.

The importance of federal rangelands to livestock production can also be measured by rancher dependency on federal forage. This dependency is measured as a percentage of how much of the annual forage required is supplied from federal rangeland. The average dependency varies greatly by state due to such factors as the amount of federal land and weather. Average dependency of permittees on federal forage is highest in Arizona where there is year-round grazing (60 percent), and lowest in Montana where there is less federal land and weather is a large factor prohibiting year-round grazing (11 percent). The cattle forage dependency percentages were 15 percent for California and 36 percent in Nevada. The comparable percentages for sheep were 24 and 43 percent.

3.11.1.2 Western Employment and Income -- Regional Trends

Changes in the livestock industry are a part of the larger dynamics in Western agriculture. Employment in the agriculture industry grew from 1.28 million jobs in 1982 to 1.48 million in 1990. Even though agricultural employment is up, it is becoming less significant in the regional economy. In 1982, agricultural employment accounted for 5.8 percent of total employment. By 1990, this proportion had fallen to 4.5 percent of all Western employment.

The 16 western and Great Plains states had a $1 trillion dollar economy in 1982 (1993 dollars). This figure increased to about $1.35 trillion in 1990. All sectors except agriculture showed positive growth in income over the period.

3.11.1.3 Western Ranch Income and Operations

The western livestock industry and federal forage are economically important, regionally and locally. Federal rangelands are essential to the economic vitality of many family farms and ranches. In some western communities, ranching is the main economic activity.

The 1990 Farm Costs and Returns Survey of the U.S. Department of Agriculture, Economic Research Service, included a random sample of U.S. beef cow-calf operations. The study analyzed the ranching economics of permittees compared to livestock operations that did not hold grazing permits on federal land, in eleven western states, and found that there were very significant differences. As shown in the following table, operators with federal grazing permits average more than twice the herd size of non-permittees (221 to 93).

Table 3.11.1.3: Western United States Beef/Lamb Livestock Operation Ranch and Herd Size, Permittees and Non-Permittees in 1990

	Permittees	Non-Permittees
Number of Ranches	6678	49,658
Average Herd Size (Number of Cows)	221	93
Percent of Operations with:		
Fewer than 100 Cows	33.9 %	61.6 %
100 to 499 Cows	56.9 %	35.1 %

500 or more Cows	9.2 %	3.3 %

Source: 1990 Farm Costs and Returns Survey cited in Rangeland Reform 94 EIS.

This survey also found that there were significant differences in ranching economics. The key difference is that permittee operation expenses were lower than livestock operators without federal permits. Permittees' expenses were $146 per cow less. Three factors account for most of the difference: 1) non-permittees bought more cattle, which is more expensive than raising your own ($43 per cow difference); 2) non-permittees did not have as much land and therefore had to buy more feed, which is also more expensive ($57/cow difference; and, 3) the non-permittee capital expenditure per cow (machinery, equipment, etc.) was much higher ($40 per cow difference) because they typically have much smaller herd sizes (average 93 animals to 221 for permittees) and the economy of scale factor applies.

While expenses were lower, per-cow receipts were also lower for permittees compared to livestock operators who did not use federal land for grazing. Permittee receipts were $63 per cow less. One explanation of the receipt difference is that cattle raised on federal land have lower weights when they are sold. Weight gains on federal lands drop significantly as the forage dries out and loses nutritional value. In the Intermountain West, while high elevation rangeland will retain higher nutritional value for much of the grazing season, lower elevation rangeland dries out significantly and cattle can actually lose weight in late summer and fall.

The market demand for beef cattle forage depends on cattle prices, which fluctuate with an approximate 10-year cycle. This is illustrated in Nevada calf prices in the last ten years (NV Agricultural Statistics Service). 1995 prices were similar to 1985 with monthly highs and lows during the year from 51.8 to 77.2 cents per pound. But in 1991 and 1993 calf prices never went below 86.3 cents per pound and in both years calves brought over one dollar a pound (high of $1.089) in some months. An 800 pound calf sold In April of 1991 brought in $871.20 for the rancher. That same type calf in September of 1995 made $414, a difference of $457.20, with perhaps no difference in what it cost to raise that calf.

The 1990 USDA Farm Costs and Returns Survey (FCRS) studied cost and return data for cow-calf operations (Shapouri et al. 1993). Based on a representative random sample of all Western livestock operations, the study found that the average permittee operation with 221 cows had cash receipts of $95,502. Total cash expenses were $75,742, and capital expenditures were $18,446, which yields a net cash return of $1,314. As seen in the following table, cash returns (revenues minus cash costs) are positive for operators at all benchmark levels of herd size and dependency on public forage.

Table 3.10.1.3(a): Cow-Calf Costs and Returns for Western Permitted Ranches				
	Permit Dependency on Federal Forage			
	Low (10.9%)	Average (36%)	Medium (43.8%)	High (85%)
Herd Size	308	221	217	93
Ranch Revenue	$153,313	$95,502	$94,178	$37,705
Revenue per cow	$ 498	$ 431	$ 434	$ 405
Ranch Cash Costs	$108,616	$75,742	$82,718	$29,333
Returns after Cash Costs	$44,697	$19,760	$11,460	$8,372
Returns per Cow	$145	$86	$53	$90

Source: 1990 Farm Costs and Returns Survey cited in Rangeland Reform 94 EIS.

3.11.1.4 Permit Value in the Western United States

A value associated with a federal grazing permit is considered in the purchase and sale of ranch property. This economic value is different from a recognition of permit value by federal land management agencies. The Taylor Grazing Act, the Federal Land Policy and Management Act, grazing regulations and case law, have consistently held that issuance of a grazing permit does not create any right or title to the permit owner.

Despite this, banks (including the Federal Home Loan Bank) and the Internal Revenue Service consider the value of permits when property is transferred. A 1993 Forest Service - BLM report found average permit values range from $36 per AUM in Wyoming to $89 per AUM in New Mexico.

3.11.1.5 Government Transfer Payments

Payments in Lieu of Taxes (PILT)

Under the PILT Act, Congress makes payments to local units of government to compensate for the lack of local property tax revenue from federal land. This payment supplements the other federal revenue sharing payments -- such as grazing fee receipts -- that local governments receive. PILT payments are subject to a payment ceiling based on a county’s population.

In 1992, Payment in lieu of Taxes for BLM and U.S. Forest Service land totaled $79,933,891.

Grazing Fee Receipt Distributions

Grazing fee receipts are distributed according to two different legislative requirements. In each case, fifty percent is returned to the BLM District where the fees were paid for projects under the BLM Range Improvement Fund. The states receive a varying percentage (12.5 to 50%) for distribution to the county of origin. In 1991, BLM grazing fee receipts distributed $8,685,000 to the Range Betterment Fund and $3,216,000 to states and counties.

3.11.1.6 Western United States Federal Rangeland Management Revenues and Costs

The costs of managing public rangeland are shown in Table 3.10.1.6. Livestock grazing expenses refers to the direct grazing program costs for such things as administering permits, designing grazing systems, livestock structures (e.g., fences) and completing NEPA analysis and documentation. The non-grazing expenses refers to work related to rangeland conditions (e.g., vegetation, water) and includes costs associated with monitoring, assessments and improvement. In 1993, grazing fee receipts collected by BLM and the Forest Service totaled $28.1 million (RR 94, Chapter 3, page 72). BLM and Forest Service Rangeland Management Program Costs for 1993 totaled $94,036,000 (RR 94, Chapter 3, page 10). The total rangeland program cost was calculated at $5.76 per AUM. In 1993, the grazing fee was $1.86 per AUM. The Farm Costs and Returns Survey of western livestock operations concluded that BLM and Forest Service grazing fee expenses represent about 3 percent of total cash cost for ranchers.

Table 3.11.1.6: BLM and Forest Service Rangeland Management Program Costs for 1993

BLM and U.S.F.S. Lands	Rangeland Program Costs		Livestock Grazing Expenses		Nongrazing Expenses
	Total ($1,000)	Cost/AUM ($)	Total ($1,000)	Cost/AUM ($)	Total ($1,000)
Management	$77,045	4.72	$52,683	3.23	$24,362
Improvements	$16,991	1.04	$12,456	0.76	$4,535
Totals	$94,036	5.76	$65,139	3.99	$28,897

Source: Range Reform EIS 94, p. 3-10.

3.11.2 State of California (and N.W. Nevada)

The economic impact analysis for the proposed Standards and Guidelines in this study will be applied to 36 of California's 58 counties. Six Southern California counties lie entirely within the California Desert District which is not a part of this Standards and Guidelines decision. The BLM land in two counties, Kern and Inyo, lie primarily in areas administered by the Desert District and only that portion of those counties within the EIS area will be considered in this analysis. Thirteen northern California counties do not have any land in the BLM grazing program. The counties included in this analysis will be discussed further in the next section of the economic analysis.

The EIS will also address potential impacts for two Nevada counties. The BLM Surprise Field Office (Cedarville, CA) and Eagle Lake Field Office (Susanville, CA) administer 1,563,308 acres of public land in northern Washoe county and 22,347 acres in northwestern Humboldt County, Nevada. All of the economic analysis for the area in Nevada will be analyzed in the county section to follow.

3.11.2.1 California Employment and Income by Major Industry

The most recent statistics on the California economy from the U.S. Bureau of Economic Analysis show that overall employment decreased while personal income rose in the period from 1989 to 1994 (USBEA 1996). But in the agriculture industry, both personal income and employment decreased and agriculture decreased in importance as a proportion of the total California economy. It should be noted that the income from agriculture is proportionally much more important than agricultural employment in California, with income and employment from agriculture representing 10 and 1.66 percent of state totals respectively.

Table 3.11.2.1(a): California Farm and Non-Farm Employment, 1989 and 1994

	1989	% Total	1994	% Total
Farm Employment	275,489	1.69%	267,629	1.66%
Non-Farm Employment	16,314,476	98.31%	16,074,977	98.34%
Total Employment	16,589,965	100.00%	16,342,606	100.00%

Source: Regional Economic Information System, Bureau of Economic Analysis, 1996

Table 3.11.2.1(b): California Farm and Non-Farm Total Personal Income, 1989 and 1994. ($000)

	1989	% Total	1994	% Total
Farm	7,489,757	13.00%	7,163,089	10.00%
Non-Farm	565,765,073	87.00%	695,166,158	90.00%
Total	573,254,830	100.00%	702,329,247	100.00%

Source: Regional Economic Information System, Bureau of Economic Analysis, 1996

3.11.2.2 California Livestock Operations and Production

There were over 22,700 livestock operations in California in 1992 with an inventory of over 5.5 million cattle and sheep. During the 5 year period from 1987 to 1992, the number of beef cattle operations decreased almost 14 percent and sheep operations decreased almost 20 percent. But while the numbers of sheep have sharply declined, the numbers of cattle have increased. The decrease in the number of cattle ranches coupled with an increase in cattle numbers has been a consistent pattern for over 30 years in California.

The increase in the beef cattle numbers, plus good market prices for beef, produced higher total cattle sales ($) in 1992. But the drop in the lamb/sheep inventory numbers was associated with decreased sales ($) for that industry.

Table 3.11.2.2(a): Number of California Farms/Ranches 1992 and 5 year Change

Livestock Type	Number in 1992	% Change 1987-1992
Cattle Farms/Ranches	19,097	-13.7%
Sheep/Lamb Farms/Ranches	3,692	-19.8%

Table 3.11.2.2(b): California Livestock Inventory 1992 and 5 year Change

Livestock Type	Number in 1992	% Change 1987-1992
Cattle and Calves	4,702,114	+2.9%
Sheep/Lambs	859,835	-12.2%

Source: 1992 Census of Agriculture, U.S. Department of Commerce, Bureau of the Census.

Table 3.11.2.2(c): California Livestock Sales 1992 and 5 Year Change

Livestock Type	1992 Sales ($1,000)	% Change 1987-1992
Cattle & Calves	$1,580,381	+ 8.97 %
Sheep, Lamb, Wool	$52,197	-0.1184

California agricultural sales totaled approximately 17.05 billion dollars in 1992, and beef and sheep/lamb livestock sales comprised 9.6 percent of that total.

By contrast, in Nevada in 1995, beef cattle and sheep/lamb sales accounted for 37.7 percent of all agricultural sales (Nevada Dept. of Business).

3.11.2.3 Government Transfer Payments -- PILT, Grazing Fees

Payment in Lieu of Taxes

Payment in Lieu of Taxes to California in 1996 totaled $10,981,192. This figure is five percent higher than the comparable 1993 payment. California and New Mexico receive the highest PILT payments per year. Nevada PILT payments totaled $7,061,300.

Grazing Fee Revenue Sharing

State and local governments also receive payments under the Taylor Grazing Act. These payments in California totaled $188,963 in Fiscal Year 1996. This figure is 34 percent higher than in 1993 and 36 percent higher than 10 years ago. Payment to Nevada totaled $357,583 for 1994 (most recent year).

These payments are based on grazing fees paid for actual use rather than the total forage authorized under a grazing permit as measured in AUM's.

In 1996, 332,117 AUM's were authorized (active preference on grazing leases). 230,537 AUM's were actually used with the grazing fee paid. There were 101,580 AUM's of non-use. (See Section 3.2.2 for a short discussion on non-use.)

3.11.2.4 BLM Rangeland Management Program Expenses

In 1996, the rangeland management program in the EIS study area cost $1,328,801. This amount represented 58.9 percent of the total California BLM rangeland program cost. The cost break down for the EIS sub-regions is shown in the following table. It was noted previously that the BLM/ Forest Service agency management cost per AUM was $3.99.

Table 3.11.2.4: Rangeland Program Costs by BLM Grazing Districts

Office	Labor Costs	Operations	Total	AUM's	Cost/ AUM ($)
SUSANVILLE	$ 572,719	$208,601	$781,320	207,895	$3.76
BAKERSFIELD	$324,306	$109,586	$433,892	123,134	$3.52
UKIAH	$101,602	$11,987	$113,589	9,470	$11.99
Total	$998,627	$330,174	$1,328,801	340,499	$3.90

Source: BLM California State Office, Range Management Program, 1996

3.11.3 Principal BLM Grazing Program Counties

The 5.844 million acres of Public Land in the EIS involves 44 counties, 42 in California and parts of two in Nevada (Washoe and Humboldt). While ten BLM Field Offices administer the public land in this region, six of the offices manage 95% of the livestock numbers as measured by authorized animal unit months (AUM's; 323,250 of 340,499).

These six BLM offices are: Surprise, Alturas, Caliente, Eagle Lake, Bishop, and Hollister. The Public Land administered by these offices lie in 21 separate counties. But most of the Public Land managed by these six Field Offices lies in the following nine counties: Fresno, Kern, Lassen, Modoc, Mono, San Benito, San Luis Obispo, Tulare, California and Washoe, Nevada. The 4,740,883 acres in these counties represent 81% of the total 5.844 million acres of Public Land identified as the total EIS study area (see Map 7).

The nine counties vary greatly in size from over 1.5 million acres of BLM land in Washoe County and one million in Lassen county to 89,506 acres in San Benito County. Table 3.10.3 also shows that only a portion of the BLM land is used for livestock grazing. In one case, Fresno County, only about half of the BLM land is grazed.

Table 3.11.3 Total BLM Acres and Acres Grazed, by County in 1994

County	BLM Total Acres	BLM Acres Grazed
Washoe, NV (CA BLM)	1,563,308	1,563,308
Lassen	1,009,458	992,665
Kern *	243,400	156,368
Mono	554,985	420,601
Modoc	272,388	227,230
San Luis Obispo	243,742	190,194
Fresno	153,528	78,447
Tulare	119,707	97,050
San Benito	89,506	45,768

Source: Total acres, CA State Office, NV, BLM GABS Program; Acres Grazed, CA BLM Field Offices.

* Acreage figures represent only that portion of Kern Co. that is within the jurisdiction of the Caliente F.O.

Humboldt County, Nevada, is a very large county geographically with over 6.2 million acres. In Humboldt County, the 22,347 acres administered by California BLM represents only a very small amount (one-third of one percent) of the total County land base. Because the land involved is such a small part of the county, and no people reside in this region of the County, no Humboldt County economic impacts will be conducted. The two livestock operators involved reside in Marin and Modoc counties in California. Most of the AUM's are held by the Modoc County resident and economic impacts will be included in the analysis for Modoc County.

3.11.3.1 County Geographic Size, Total Population and Population Density

There is a large difference in population size and density between the nine principal counties. Fresno and Kern counties have major metropolitan areas and over 600,000 county residents. On the other hand, three counties - Lassen, Mono and Modoc - have less than 30,000 people and very low population densities across the county.

Table 3.11.3.1: 1994 Population Size, Acreage, and Population Density, by County

County	Population	Acreage	Density/Sq Mile
Fresno	729,700	3,851,450	121.3
Kern	609,300	5,223,700	74.6
Tulare	343,300	3,097,220	70.9
Washoe, NV	282,900	4,178,649	43.3
San Luis Obispo	223,700	2,314,070	61.9
San Benito	41,000	890,120	29.5
Lassen	28,100	3,021,190	5.9
Mono	10,400	2,004,410	3.3
Modoc	9,700	2,690,310	2.3

3.11.3.2 County Employment and Income

The following tables rank the nine counties relative to the importance of the agricultural industry as a percentage of total employment and income. Agricultural employment is proportionally most important in Modoc County but agricultural income is the most important in the Central Valley county of Tulare.

Table 3.11.3.2(a): Counties Ranked by Importance of Agricultural Industry Employment

Location	Agricultural Employment	Total Employment	Agricultural Percentage
California	267,629	16,074,977	1.7%
Modoc County	666	4,106	16.2%
San Benito Co	2,021	16,317	12.4%
Tulare Co	16,809	152,207	11.0%

Table 3.11.3.2(a): Counties Ranked by Importance of Agricultural Industry Employment			
Location	Agricultural Employment	Total Employment	Agricultural Percentage
Fresno Co	28,874	361,357	8.0%
Kern Co	16,965	262,281	6.5%
Lassen	596	11,833	5.0%
San Luis Obispo	3,922	110,139	3.6%
Mono	102	7,718	1.3%
Washoe Co, NV	425	194,096	0.2%

Source: Regional Economic Information System, Bureau of Economic Analysis, 1996

Table 3.11.3.2(b): Counties Ranked by Importance of Agricultural Industry Income			
Location	Agricultural Income (000's)	Total Income (000's)	Agricultural Percentage
California	7,163,089	702,329,247	1.0%
Tulare County	544,453	5,418,349	10.0%
San Benito Co	49,371	707,677	6.9%
Fresno Co	757,229	12,701,465	6.0%
Kern Co	565,341	10,057,115	5.6%
Modoc Co	4,286	150,765	2.8%
Lassen	7,651	440,807	1.7%
San Luis Obispo	68,978	4,286,114	1.6%
Mono	1,685	211,345	0.8%
Washoe Co, NV	3,465	7,655,901	0.1%

Source: Regional Economic Information System, Bureau of Economic Analysis, 1996

The very low relative importance of agriculture in Washoe County, Nevada is due to the fact that the city of Reno dominates the county's economy. Although Mono County is a rural county with a small population, agriculture contributes only a small percentage of employment and income there too. These two very different counties have one important economic element in common -- a strong tourism industry. The following table documents the economic impact of travel and tourism in each of the principal counties. It clearly indicates that Mono County, with more than 10 times the employment related to tourism than Modoc County, is very different from the other two small population counties -- Lassen and Modoc.

Table 3.11.3.2(c): Principal Counties Ranked by Travel/Tourism Economic Impact 1994

County	Employment Related to Tourism	Expenditures ($000) Related to Tourism	Local Taxes ($000) Generated by Tourism
San Luis Obispo	10,671	$787,240	$13,230
Fresno	10,155	$750,420	$12,900
Kern	9,894	$725,710	$10,570
Tulare	5,100	$375,250	$4,310
Mono	4,333	$310,500	$5,750
San Benito	948	$77,470	$1,090
Lassen	892	$63,210	$760
Modoc	367	$26,440	$300
Washoe, NV	(no data)	$3,726,000	n/a

3.11.3.3 Livestock Operations and Production

There is a very large difference in the size and relative agricultural importance of the livestock industry in the nine counties. The livestock industry in Tulare County, with a livestock production value of 223 million dollars in 1995, has over forty times the value of Mono County. But the proportional agricultural importance of the livestock industry is the highest in Mono because over 40 percent of total agricultural production is from livestock production. In two other counties, Modoc and Lassen, the livestock industry represents over ten percent of the value of agriculture in the county.

Table 3.11.3.3: County Livestock Industry Proportion of Total Agricultural Production Value, 1995. (1)			
County	Livestock Value Proportion	Livestock Production $	Total Agricultural Production $
Mono	41.3%	$ 5,518,148	$ 13,357,268
Modoc	17.2%	11,090,000	$ 64,252,655
Lassen	17.0%	8,038,001	$ 47,227,000
Tulare	8.5%	223,207,000	$ 2,610,290,000
San Luis Obispo	8.1%	26,188,000	$ 321,598,000
San Benito	6.1%	9,867,000	$ 160,474,000
Kern	4.2%	83,607,000	$ 1,978,319,000
Fresno	3.6%	115,665,000	$ 3,167,157,000
Washoe	46.3%	5,798,612	$ 18,028,000

Selected Counties Department of Agriculture, 1995 Agricultural Crop Reports
(1) Timber not included

Because of large yearly fluctuations in the price for beef cattle, the value of livestock sales and, therefore, the place of livestock sales in the total agricultural economy vary greatly over time. As was pointed out earlier, an 800 pound calf might have brought $872 in April of 1991. But that same type calf in September of 1995 was worth only $414, a difference of $457. The economic importance of livestock sales for a county is also significantly affected by the livestock inventory, the number of animals being raised. From 1992 to 1996 in Washoe County, the number of cattle and calves rose from 31,000 to 33,000; but sheep and lambs decreased from 6,400 to 5,000. Across the state line in Modoc County, the cattle inventory dropped from 53,000 to 45,000 and sheep/lambs dropped from 9,000 to 5,000.

The Modoc County statistics from 1992 to 1995 clearly illustrate the yearly fluctuations and economic volatility of the livestock industry. In 1992, total livestock sales for cattle and sheep totaled $26,971,000, representing 46.9% of total county agricultural production (1992 Census). 1995 total livestock production was worth $11,090,000 and was 17.2 % of total agricultural sales in Modoc County. In summary, from 1992 to 1995, the livestock operators of Modoc County experienced a $15,881,000 decrease in income, representing a 58.8 percent drop in their livestock income.

Table 3.11.3.3(a): Farms with Grazing Permits by County, 1992			
County	BLM Permits	USFS Permits	Total Number of Farm with Permits
Modoc	89	75	128
Kern	55	38	83
Lassen	54	35	68
Fresno	20	21	43
Washoe	20	4	26
Mono	16	17	26
Tulare	13	19	35
S.L. Obispo	12	17	47
San Benito	12	1	15

Source: 1992 Census of Agriculture

3.11.3.4 Government Transfer Payments -- PILT, Grazing Fees

Payments in Lieu of Taxes

Two Federal Government payments to counties are related to the BLM grazing program. The Payment in Lieu of Taxes program compensates the counties because the federal government does not pay property taxes. The Taylor Grazing Act distributes a percentage of the local grazing fees to the counties. Both payments are based on the geographical location of the land. In the EIS study area, it is not uncommon for grazing permit owners to reside in a different county than the location of their grazing allotment. In that case, their fee payments will go to their allotment location counties and not their counties of residence.

Table 3.11.3.4(a): Payment in Lieu of Taxes, by County, 1996.	
County	Payment
Fresno	$316,955
Kern	$727,008 (1)
Lassen	$179,185
Modoc	$185,233
Mono	$191,688

Table 3.11.3.4(a): Payment in Lieu of Taxes, by County, 1996.	
County	Payment
San Benito	$77,334
San Luis Obispo	$357,141
Tulare	$746,639
Washoe	$1,071,123
California Total	$10,981,192

Source: CA and NV BLM State Offices. (1) Includes the Ridgecrest Field Office payments

Tulare and Kern counties receive over three times the PILT payments of Lassen, Modoc and Mono counties, reflecting the importance of population size in the payment calculation formula.

Grazing Fee Revenue Sharing

The amount received by a county from grazing fees is greatly influenced by which legislative formula applies. Kern County's 1996 payment of $22,487 was twice that received by Lassen County, even though Lassen has more AUM's, because the share percentages were 50% versus 12.5%.

Washoe County, NV received $21,043 in grazing fees revenue sharing for 1996. Three BLM Districts were involved. The contribution of each was: NORCAL EAST $14,314, (the Surprise and Eagle Lake areas combined), Winnemucca $2,649 and Carson City $4,080. Humboldt County, NV received $40,186.44 in grazing fee revenue sharing for 1996, but only $104.92 for the lands managed by the Surprise Field Office.

Table 3.11.3.4(b): Grazing Fee Revenue Sharing by County, 1996 CA / 1994 NV	
County	Payment
Kern	$22,487
Washoe (NV)	$21,043
San Luis Obispo	$14,895
Lassen	$11,820
Fresno	$6,511
Modoc	$3,666
Mono	$2,974
San Benito	$2,900

Table 3.11.3.4(b): Grazing Fee Revenue Sharing by County, 1996 CA / 1994 NV	
County	Payment
Tulare	$1,340

Source: CA BLM State Office, Range Management Program 1996 data; Harris, Thomas, Federal and State Land-Based Payments in Nevada, 1994 data, unpublished report, U. Nevada, Reno, Department of Applied Economics and Statistics, 1996.

Table 3.11.3.4(c): BLM Authorized Grazing AUM's by County, 1996	
County	Number of Authorized AUM's
Kern	23,114*
Washoe (NV)	94,394**
San Luis Obispo	26,779
Lassen	80,217
Fresno	13,784
Modoc	28,361
Mono	33,509
San Benito	6,453
Tulare	3,306

* Includes only the AUM's administered by the Caliente Area Office
** Does not include the grazing AUM's administered by the Carson City and Winnemucca, NV Field Offices.

3.11.3.5 Permit Value

As a general rule, a ranch with a federal grazing permit is worth more than a ranch without a permit. In theory, the value of the permit at least partially reflects the capitalized difference between the grazing fee and the competitive market rate that could be charged for federal forage. Research has found that permit values are influenced by a variety of market forces at different times and in different places (BLM 1994, p 3-71). The permit value in Modoc County has declined about $6 per AUM since the 1980's. Lending institutions include the value of the permit in loans and sales. In addition, the Internal Revenue Service considers the value of permits when property is transferred. In Modoc County in 1996, the County Tax Assessor's Office valued the permit at $30 per AUM. A study of sales of BLM and Forest Service grazing permits in 1991 found a sale price of approximately $30 per AUM (Modoc County Assessor). Hypothetically, if a ranch with land and buildings worth one million dollars had a grazing permit for 1000 AUM's, the permit would add $30,000 to the value of the ranch ($30 x 1000= $30,000). Thus, any change in the permit, such as altering the number of AUM's authorized, or raising the AUM grazing fee, could change the benefit of the privilege to graze on federal land and reduce or eliminate the "value" of the permit. The discussion of permit value must include an understanding that federal law states that the issuance of grazing permits creates no right, title, or interest in federal lands or resources.

3.11.3.6 California Possessory Interest Tax

In California, the assessed value of grazing permits is subject to a possessory interest tax. Taxable possessory interests are property interests in publicly owned real property. Both grazing permits and agricultural leases give rise to taxable possessory interest.

In Modoc County, taxable possessory interest grazing rights had an assessed value of $4,343,419 for the 1990 tax roll. This equates to approximately $44,000 in taxes for the county. The formula for calculating the assessed value involved four components including a sales price of $30.00 per AUM and the 1991 AUM grazing fee of $1.97.

3.11.3.7 Farm Real Estate Values

The value of land has both long and short term significance. It is a source of financial worth in the long term, affecting retirement and inheritance; and it is the collateral for loans in the short term.

In 1995, California rural land prices averaged $2,215 per acre, while Nevada prices averaged $289 per acre (Economic Research Service, USDA, 1996). Over the past 10 years (1986 - 1995), this represents a 28 percent increase in land value in California and a 32 percent increase in Nevada. An average 2,000 acre ranch would cost $4,430,000 in California compared to $578,000 in Nevada. That average Nevada ranch would have increased in value over the past ten years by $131,206.