Sierra Nevada Grazing in Transition: The Role of Forest Service Grazing in the Foothill Ranches of California

Executive Summary

After gold was discovered in California's foothills in 1849, would-be millionaires arrived in droves. Cattle were driven to foothill encampments to feed the miners. By the late 1850s the boom times of the placer mining era were over, and most people left, but a pattern of grazing livestock in the mountains during the summer by California and Nevada ranchers began and persists to this day. When the United States Forest Service was established in the early twentieth century, much of this mountain and foothill grazing land was placed under federal management. Today, the dynamic working relationship between ranchers and the Sierra landscape is changing again as another wave of people migrates to the mountains and foothills. This report summarizes a study that examines the relationship of publicly owned, Forest Service-managed summer grazing land to privately-owned foothill ranches and explores the economic and social sustainability of ranching in the Central Sierra Nevada.

For this survey, interviews were conducted with twenty-three ranchers in California's Central Sierra Nevada foothills. Each used Tahoe, Stanislaus, or El Dorado National Forest lands for summer grazing. The goal was to better understand their motivations for ranching, the viability of their current operations, and how they might respond if Forest Service lands in the Sierra became unavailable. For comparison, fourteen ranchers with similar herd sizes, but who do not use Forest Service grazing land, were also interviewed.

The ranchers in this survey had an average herd size of about 300 cows and owned foothill ranch property in the Central Sierra. Those using Forest Service lands had an average of 1,730 acres, while those who did not owned an average of 3,000 acres. All but one of them leased some land, public or private. Most often they leased both. Overall, eighty-five percent leased some private lands. Ranching requires extensive acreages and cattle are often moved from season to season to follow the green grass. In California, winter lowland range is generally valley grassland, foothill grassland and oak woodland. More than two-thirds of all ranchers interviewed used foothill oak woodland in winter and spring. Then, as the late spring and summer heat dries the forage in the lower elevations, cattle are transferred upland to forest clearings, open forests, and mountain meadows.

Eighty-five percent of the ranchers leased private land, and all but one leased public or private land. Most often, they leased both.

Irrigated pasture, an alternative source of green grass in the summertime, has been declining in acreage in the area for some time. Central Sierra ranchers state that they graze Forest Service grazing lands primarily because they provide green forage, because they are a good value compared to leasing private land, because alternatives are hard to find, and because it is a valuable part of their history and their culture. Ranchers who do not use Forest Service land in the summer often lease private or other public land or pasture in summer, and tend to feed more hay.

Ranchers attribute 40 to 50% of their income to summer grazing.

Ranchers who graze Forest Service land, as well as those who do not, attribute 40 to 50% of their income to their summer grazing lands.

Ranchers face numerous challenges grazing Forest Service lands. Most of the ranchers using Forest Service lands stated that "regulations" were a highly important influence on their ability to use summer range. In recent decades, federal land management agencies have shifted their emphasis to greater protection of wildlife and water, as habitat for sensitive, threatened, and endangered species shrinks and recreation usage and urban development grows.

In addition, fire suppression efforts have reduced the long-term productivity and extent of understory vegetation. Consequently, livestock grazing on Forest Service land has declined greatly since the First World War.

When asked how they would cope with further reductions in Forest Service grazing use, most ranchers would prefer to find other leased land. The next most frequently selected option was to reduce the size of their herd. Despite the majority's belief that the loss of Forest Service grazing would reduce their income, selling the ranch was one of the least preferred ways of coping with the loss of Forest Service grazing. Only 35% of ranchers who lost all Forest Service grazing would seriously consider selling the whole ranch or part of the ranch. Nevertheless, overall ranchers want to persevere: the vast majority have no plans to sell in the immediate future, though all have observed the sale of several nearby ranches. Diversifying an operation was not seen as a preferred way of coping with reductions in Forest Service grazing, though many carried out some diversification in an attempt to augment income.

To cope with reductions in Forest Service grazing, most ranchers would prefer to lease more land.

Comparing the costs of alternative sources of forage in order to evaluate the impact of a loss of grazing allotments on ranches in the Central Sierra is problematic for several reasons. To begin, accounting for all costs is difficult, and some costs are hard to quantify. In addition, the long-term availability of some of the alternatives is in question. Another factor is that the wide variation in the costs and availability of alternatives, and in the flexibility of livestock operations, makes generalizations based on an "average ranch" suspect. Finally, monetary profit is not a clear-cut predictor of the survival or persistence of ranches.

Dependent largely on natural forage production, the ranch cycle of production has evolved with the public summer range as a key part of the annual forage calendar. Ranch owners may have been going up into the mountains every summer with the

Leased land, according to the ranchers interviewed, is in short supply, and there is tough competition for leases.

stock for their entire lives, and value that time beyond anything revealed in dollars and cents. Comparable corporate timber lands that intermingle with Forest Service grazing lands are leased for about $3.00 per cow per month more than the Forest Service charges, but the use of one is dependent on the other. Ranchers estimate that using foothill private leases at current rates would cost them $6.50 more per cow per month than using Forest Service lands. The cost difference between public and private leases is to some extent capitalized into the ranch value, and relative costs vary to a large degree among ranches.

Another key factor to consider for ranchers is the reduction in foothill grasslands and pasture available for leasing. Increasingly, irrigated pasture and grassland in the Sierra foothills is being developed or converted to viticulture and other forms of intensive agriculture. Though land held for development by investors is often leased for a number of years, it is a temporary situation. As a result of these changes, leased land, according to the ranchers interviewed, is in short supply, and there is unprecedented competition for leases.

The majority of ranchers report that the high value they place on the ranching way of life is an important reason they stay in business. Ranching is not generally seen by ranchers as the ideal way to make money. Small- and medium-sized ranchers using Forest Service grazing permits with less than 500 head of cattle do not appear to make a consistent monetary profit on their ranch, relying on off-ranch income to get by in at least some years. How they would absorb the higher costs of more leasing is unclear. Yet, most Sierra ranchers, particularly those with grazing permits, want their children to continue

Most of those grazing livestock on Forest Service land have no desire to sell their ranches, but a third stated that they would have to consider selling if they lost their grazing permit.

ranching and to pass on the family tradition. More than half of all ranchers have a member of the family working off the ranch to support it.

Overall, the loss of Forest Service grazing would be a negative factor for many ranches financially, yet a significant part of an owner's motivation for ranching is tradition, lifestyle, family, and amenity benefits. The vast majority of ranchers report that living and working in naturally beautiful surroundings is an important reason for continuing to ranch. The loss of Forest Service grazing is one part of a complex of factors influencing rancher use and ownership of foothill lands, including land use conflicts, a decline in ranching-related services and supplies, escalating land values, inheritance issues, and poor market, each of which contribute to a decline in ranches. Despite the evident problems, at the time of this survey, most ranchers were optimis-

The vast majority of ranchers surveyed responded that living and working amidst natural beauty was a highly important reason to continue ranching.

tic about the future of ranching in the Central Sierra, and wanted to continue to take part in it.

Some Ideas and Recommendations

Conserving the working landscapes of the Central Sierra calls for coordination among state and federal agencies, local conservancies, local governments, ranchers, communities, and others who want to protect working landscapes in the Sierra. There are potential opportunities to augment ranch sustainability and income that should be explored. These may include:

1. Produce ranch products with a higher market value such as organic and natural meats. Demand for grass fed, organic, and natural meats is increasing. There are numerous infrastructural and marketing problems, and profitability is not assured, but California range operations can produce this product.

2. Compensate ranchers for the open-space values they provide through conservation easements and mitigation. Because ranching is an extensive rather than an intensive agricultural use, ranch lands protect many resource values. Provision of public goods such as wildlife habitat, viewshed, and carbon-sequestration can provide some income to the ranch through these measures.

3. Encourage ranchers to manage for diverse goals. Because many ranchers are oriented to the amenity and lifestyle values of ranching, they may be receptive to managing for diverse goals. Diversification of ranching operations may increase ability to generate profits in a market environment that is changing, but diversification may also increase a lifestyle motivated owner's sense of satisfaction.

4. Inform landowners of the benefits of participation in state and federal programs such as the Williamson Act, Grasslands Reserve Program, Farmland Protection Program, and Conservation of Private Grazing Land Program. These seek to compensate ranchers for environmental stewardship and the production of open space and wildlife habitat, in addition to their production of beef.

5. Utilize grazing to reduce fire hazard. Housing developments increase the demand for fire hazard reduction. Local planning that considers opportunities to use ranch lands as a fuel reduction buffer can address this demand. Coordination with public lands in the planning process would also help.

6. Identify ways to improve the certainty of forage supply. Stable forage availability is key to stable ranches. Alternatives that address assuring forage

Ranching is not seen as the ideal way to make money, yet most ranchers want their children to continue ranching and to pass on the family tradition.

supplies despite irregular weather, reductions in public forage, and the conversion of foothill grazing lands to other uses will contribute to the persistence of ranches.

7. Ensure that the appropriate planning and infrastructure exists to support ranching operations. Coordinated planning with the agricultural community is crucial factor to conservation of ranch lands. Ranches need extensive, preferably interconnected, rangelands, with buffering from vehicles and dogs. Many wildlife species need the same. In addition, there needs to be a business community sufficient to support infrastructure including large animal veterinary services, packing houses, and markets.

A Report to *The Sierra Nevada Alliance, the California Cattlemen's Association, and the California Rangeland Trust.*
June 2002, Adriana Sulak and Lynn Huntsinger, University of California, Berkeley

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Project Sponsors and mission statements:

Sierra Nevada Alliance
Working to protect and restore the natural and community values of the Sierra Nevada.
www.sierranevadaalliance.org

California Cattlemen's Association
Representing California's ranchers and beef producers in legislative and regulatory affairs since 1917.
www.calcattlemen.org

California Rangeland Trust
To conserve the open space, natural habitat and stewardship provided by California's ranches.
www.rangelandtrust.org

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Glossary

AUM**:** An Animal Unit Month, or AUM, is a standardized measure of forage, generally interpreted as the amount consumed by a mature cow in one month. The Forest Service considers an AU (animal unit) to be a mature 1,000 pound cow or the equivalent with an average daily forage consumption of 26 pounds dry matter per day.

BLM: The Bureau of Land Management. An agency of the Department of the Interior, the BLM manages more than 200 million acres of public land in the United States. Most BLM managed land is not forested.

Forage: Plant material that can be eaten by livestock or wildlife. Forage can be dried as hay, or eaten as it grows. Grass is a forage. Green forage is live plant material such as grass or shrub leaves.

Grazing Allotment: The area of land designated by a permit for grazing allocated by the United States Forest Service or the Bureau of Land Management. These allotments have often remained with a single ranching property since the establishment of Forest Service grazing management shortly after the turn of the century.

Grazing Permit: A permit for grazing by fee. When used to describe BLM or Forest Service permits, it means that the rancher pays a fee to graze an allotment at times, and with the number of stock, stipulated by the agency.

Head Month: Similar to an AUM, though not as precise.

RDM**:** Residual dry matter. Describes the ungrazed material left behind after a grassland has been grazed. Usually dry, because it is most often used to describe an annual grassland where plants are dry at the end of the grazing season.

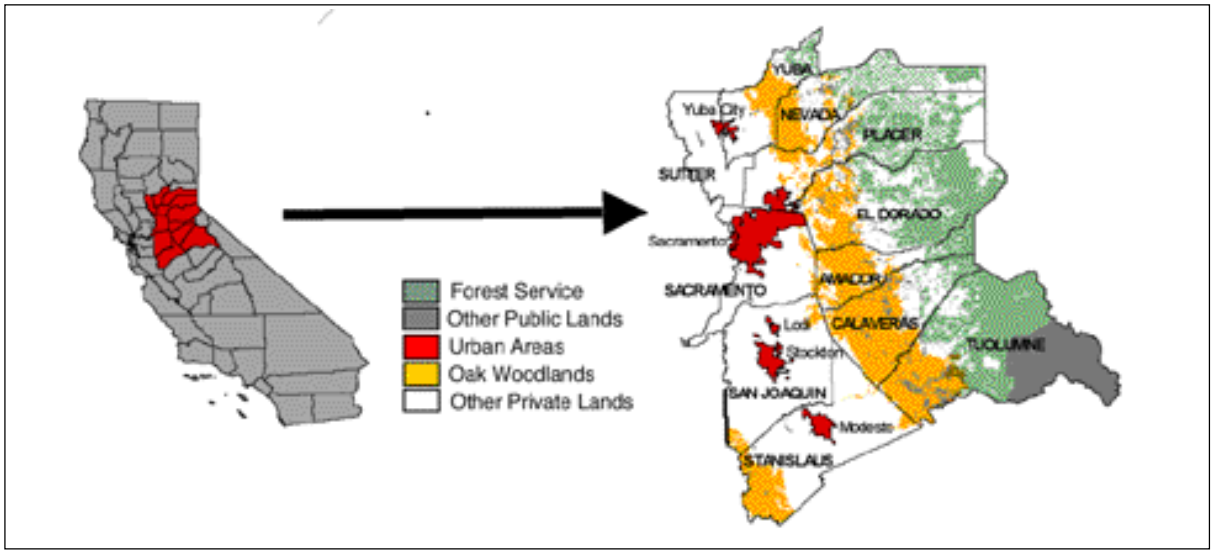
I. Introduction

This project was examines the interlinkage between publicly-owned summer range and the sustainability of foothill ranching, including economic, management, and social interconnections. Many thousands of acres of Sierra foothill woodland are owned by ranchers, some of whom have a permit to graze Forest Service land as part of their normal production cycle. The impact of a twenty percent reduction in grazing permitted on these lands, or grazing allotments, as estimated in a recent Forest Service planning effort, is unknown and widely debated. Here the results of interviews and surveys of Central Sierra ranchers about their use of grazing permits are presented. With fewer and fewer large working ranches left in the Sierra foothills, and thus fewer large tracts of undeveloped open space, identifying the factors that affect the sustainability of these ranches is important to the future of the Sierra Nevada landscape.

Statewide, most of the privately held undeveloped land in rural areas is owned by ranchers, including about 37% of the private land in California, or about 7.5 million hectares of grasslands, woodlands, and shrublands (Forero and others 1992). These rangelands are being converted from extensive grazing operations to housing and intensified agriculture at an accelerating rate. The California Cattlemen's Association, the California Rangeland Trust, and the Sierra Nevada Alliance sponsored this study out of their common concerns about the future of ranchland and working ranches in the western Sierra foothills, one of the fastest-growing regions in the State (Ewing and others 1988). The population of the Sierra Nevada more than doubled between 1970 and 1990, and nearly five out of every six Sierra Nevada residents lived in the western foothills in 1990. That fraction is expected to grow along with the continued expansion of regional employment centers in the Central Valley (Duane 1996).

Because ranching demands use of extensive acreages, ranches tend to be large compared to farms and residential properties. Collectively and locally then, the land use decisions that ranchers make have large-scale effects on the landscape. Previous work has identified estate taxes, heirship issues, increasing property taxes, the variable economic condition of the industry, conflicts with urban neighbors, and an overall reduction in available grazing lands as pressures affecting ranch sustainability in California's grasslands and woodlands (Hargreave 1993; Johnson 1998; Liffmann and others 2000). One less well understood but potentially crucial factor for a Sierra ranching operation is access to summer forage, when foothill woodland rangelands dry up. A substantial number of ranchers in the Sierra foothills use Forest Service grazing permits for this portion of their annual grazing cycle.

In winter 2000 a Project Advisory Committee was appointed that included representatives of the study sponsors, other conservation organizations, UC Cooperative Extension, experts in economics, and researchers with similar interests. The Advisory Committee re-



viewed the development of an oral questionnaire and a mail-back survey for ranchers with grazing permits ("permittees") on the Tahoe, Stanislaus, and Eldorado National Forests in the central Sierra Nevada mountain range of California (Figure 1). The oral questionnaire about factors that link public land access and a rancher's private grazing operation, including some basic economic information. Interviewees also were asked for financial information applicable to the health of the livestock operation, and for their thoughts, experiences, and predictions about an interrelationship of public and private lands. Detailed financial information for each ranch was gathered through a survey left with each interviewee to mail back.

In 2000 there were sixty permittees on the rosters of three National Forests in the study area. Participants in this study included ranches in Sutter, Yuba, Sacramento, San Joaquin, Stanislaus, Tuolumne, Calaveras, Amador, El Dorado, Placer, and Nevada counties, with some owning land or leasing outside the study area. In summer and fall 2000, twenty-five interviews, of 42% of the total permittees, were conducted, and nineteen written portions returned, eleven with the financial section filled out to some degree.

For the purposes of comparison, thirteen Central Sierra ranchers who lacked Forest Service grazing permits ("non-permittees") were surveyed in 2001. The non-permittee sample is not representative of all ranchers without Forest Service permits, as that would include an extremely broad range of operations. Instead, the non-permittees were selected with numbers of livestock similar to permittee ranches. Five returned the mail-back financial section, two fully completed. The low rate of return of the financial detail section by non-permittees results in a case study rather than statistical comparison. In general, non-permittees were more reluctant to reveal detailed financial information. Because this was expected, some less sensitive economic questions were included in the oral part of the survey, so many comparisons are possible using the full non-permittee sample. When a statistical test is performed to validate a comparison, all significance values of less than $P < 0.2$ are reported. This value indicates that there is less than a 20% chance that the results reported are due to chance alone. Higher values are reported in the tables as "ns," or "not significant," meaning there is no real difference.

When interpreting survey data, it is important to remember that the information provided by a respondent may be incomplete or even inaccurate. Some ranchers have a better idea of the finances of their operation than do others. Some may decide that certain types of information are too personal to include.

II. Sierra Livestock Production

Ranchers using Forest Service Sierra Nevada mountain forage are practicing a pattern of livestock grazing common throughout the pastoral world, and notable in the Sierra since the 1850s (Figure 2). "Transhumance" is the herding of animals from the lowlands in winter to the uplands in the summer, as described in the Alps of Switzerland by Sorre (1950). Changes in elevation correspond to changes in rangeland cover types, each of which is suitable for livestock grazing at different times of the year. On the west side of the Sierra, winter lowland grazing land is generally valley grassland, foothill grassland, and oak savanna, while the summer uplands are usually forest clearings, open forests, and mountain meadows. This system allows a rancher to range feed a cow herd all year round using naturalized and native grasses and shrubs. These ranches are extensive production enterprises and use a minimum of supplemental nutrients and hay.

The California forage supply is highly seasonal, especially in the foothills where the ranches in this study are located. In spring, rapid growth and good nutritional value are characteristic of the annual grasslands and oak woodlands of the foothills. In summer, forage is dry and of low nutritional value in the foothills, but in the mountains there is still green feed to be found. The forage in the national forests grows in montane meadows and in the understory where there are openings in the forest canopy. Ideally, under traditional production patterns, the abundant green growth of spring in the foothills, combined with the green meadow grasses of the higher elevations in the summer and early fall, provide for maximum calf growth and good maternal health.

Use of Sierra Nevada montane range for summer grazing predates the establishment of the national forests

around the turn of the century, and homesteaders and other ranchers owning nearby base ranches are allowed to continue to graze their traditional ranges through a Forest Service permit system. A summer grazing permit specifies a location, time of year, number of livestock, and often, a system of grazing for the rancher holding the permit. Numbers, timing, and duration can be changed by the Forest Service from year to year or permanently as deemed necessary to protect resource values or to meet other demands on the land designated by the permit. A rancher's permitted grazing area is called a "grazing allotment." Ranchers may take all or a portion of the herd up to the allotment every year depending on their particular circumstances. Historically, the number of livestock permitted by the Forest Service peaked during WWI, and has generally declined ever since - to less than 10% of historic levels in the well-documented case of the Shasta Trinity National Forest (Forero 2002).

The typical livestock herd using Forest Service permits is what is called a "cow-calf" herd. Brood cows, often with generations of history on a particular ranch, are kept year round by the rancher and bred annually. Most often the calves produced each year are marketed at weaning, at about six to nine months in age. Sometimes, if a rancher has a substantial amount of winter pasture or a source of agricultural by-products, weanling animals are kept for a longer period of time, and rarely, marketed as ready for consumption after they reach a year or more in age. Most often calves are sold to operations that have some means of feeding and eventually fattening them for market, often using agricultural by-products and/or grains. They might be shipped as far as western Great Plains feedlots to take advantage of low corn prices. Outside of some parts of the growing "boutique" beef market, the cattle industry is stratified. Cow-calf producers are therefore vulnerable to the volatility of the speculative livestock feedlot and processing industries, yet the nature of cow-calf production excludes short-term responses to changes in markets or in forage availability.

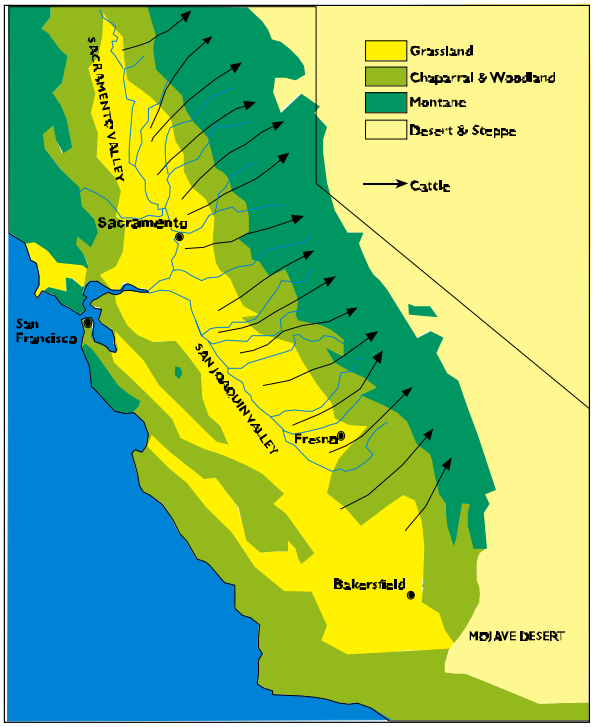


Figure 2. *Traditional herding patterns along the western slope of the Sierra Nevada, California (after Rinschede 1984).*

The ranchers in this 2000 and 2001 survey tended to be male, and in their late fifties or early sixties. More than two thirds of them live on their ranches year round, use foothill oak woodland in winter and spring, and use traditional practices such as roping animals at branding time. Typically the ranch is a fall-calving cow-calf operation (Table 1), requiring the rancher to find forage all year to maintain the brood cow herd.

Table 1. Characteristics of Central Sierra ranchers with and without Forest Service grazing allotments, 2000-2001.

	Permittees (n=23)	Non-permittees (n=14)
Mean head of cows	329	362
Mean number of yearling cattle	81	64
Mean acres owned	1710	3000
Fall calving herd	83%	69%

III. What is a Permit Worth to the Rancher?

What is the financial value of a Forest Service allotment to a Central Sierra rancher? The question is part of assessing the impact of changes in allotment use, and can be addressed in several different ways:

1. Ask the rancher.

2. Calculate the proportion of the herd's forage supplied by the allotment.

3. Examine the availability and price of alternatives.

4. Compare the actual costs of summer range for non-permittees and permittees.

5. Analyze the financial role of an allotment.

Results of each of these methods are presented in this section. Each method has serious limitations (Appendix I), but sheds some light on the question. Allotment value, however, is not just financial. The allotment used by a ranch has often been part of it for a hundred years or more. Dependent largely on natural forage production, the ranch cycle of production has evolved with public summer range a key to providing the herd forage. Ranch owners may have been going up with their stock into the mountains every summer for their entire lives, and value that time far beyond what is revealed in dollars and cents.

1. Asking the Rancher

The ranchers interviewed estimated that on average a little less than half of their income is attributable to the use of the allotment, though estimates varied from 10% to 80% (Table 2). The majority, 87% of the permittees and 71% of non-permittees, reported that the use of the allotment or summer lease was of "high importance" to the profitability of the ranch.

Table 2. Importance of summer leases to Central Sierra permittees and non-permittees, 2000-2001.

What % of your ranch income comes from use of the allotment or summer range?			
	n	Mean	Range
Permittee	23	41%	10-80%
Non-Permittee	13	48%	20-70%
Total	36	44%	10-80%

Permittees were also asked, "How important to you are the following reasons for using your Forest Service allotment(s)?" Most important was the use of the allotment for green forage in the summer time (Table 3). The costs of alternatives, a lack of alternatives, economic sense, lifestyle, and convenience were also important reasons for using an allotment for most respondents. Use of the allotment by previous owners was not seen as a particularly important rationale for continuing to use it.

2. Proportion of forage supplied by the allotment

The proportion of a ranch's total forage demand met by the Forest Service allotment is an indication of how

Table 3. Reasons permittees use Forest Service allotments, 2000.

	Not Important	Somewhat Important	More Important	Highly Important
Green feed (n=17)	0%	6%	6%	88%
High cost of alternatives (n=17)	6%	6%	18%	71%
Lack of alternative (n=18)	11%	6%	17%	67%
The most sensible economically (n=18)	0%	11%	22%	67%
Lifestyle, enjoy high country (n=18)	6%	6%	28%	61%
Convenience (n=19)	5%	32%	21%	42%
Used by previous owners (n=14)	50%	14%	7%	29%

Table 4. Percent of permittee forage from the Forest Service allotment in Animal Unit Months (AUM's), 1999.

n=17	Ranch total AUM's	USFS permit AUM's	% of total ranch AUM's from allotment
Average	5,197	725	18%
Range	906—14,220	75—2,044	2%—45%

much is contributed by an allotment, though it does not include an assessment of the value of forage available in summer, when green forage is in short supply.

On average 18% (range of 2% to 45%) of a ranch's total forage supply comes from the Forest Service allotment (Table 4). The analysis is done in "Animal Unit Months" (AUM's), a standard unit of rangeland forage production that is the amount of forage it takes to feed the average cow for one month. This estimate may be low, because calves accompanying cows on the allotment may not be counted.

An evaluation based on AUM contribution alone, however, does not take into account the seasonal contribution. A lack of available replacement forage in summer, when lowland range loses nutritional value, is among the most important reasons for a permittee highly valuing Forest Service forage. Forest Service permittees often specifically noted that they find summer forage the hardest to replace. Ranchers who do not have Forest Service permits said that finding adequate forage is difficult all year round. Two non-permittees reported that they did not have trouble finding forage because they had long-term leases.

3. Prices of alternative summer forage and feed

The prices of alternative sources of feed shed some light on the financial impact losing the allotment might have on a ranch. Feeding hay, leasing irrigated pasture, and leasing dryland range pasture are alternative feed sources already used to some extent by both permittees and non-permittees in our study. All but one of the interviewees fed hay at some time during the year, mostly in the fall and winter. Almost three-quarters buy some hay, and 16% grow at least some of it. A fifth of the non-permittees, compared to none of the permittees, fed hay in the summer, with 14% of them feeding year round. The sources of summer forage used by non-permittees were highly varied. A little over 70% of non-permittees leased some ground in summer and half use some irrigated pasture, leased or owned. Costs of feed sources vary due to differences in production costs, quality, and availability of hay and pasture in each county (Table 5).

The fees for using Forest Service lands are much lower than the prices of alternative forage sources. However, for those ranchers who provided detailed cost data for use of the Forest Service allotment, costs per AUM of using Forest Service land seem quite high (Table 6, column "C") when costs of transportation, labor, and so forth are included. Analysis of the prices of alternatives in the county of the home ranch argues for replacement of the allotment with dry pasture as the least expensive alternative. Prices for Nevada, east of the Sierra crest, (row "ii") are lower, but in many cases

Table 5. Replacement costs used to calculate alternative feed costs, 1999 (County Agricultural Commissioner Crop Reports).

County	Cost of Hay per Ton	Rental Cost of Irrigated Pasture per Acre	Rental Cost of Range Pasture per Acre
Calaveras	$95	$120	$11
El Dorado	$110	$125	$10
Nevada	Not listed	$125	$8
Placer	$86	$125	$8
Tuolumne	$89	$130	$8

Table 6. Average prices of forage supply alternatives for ranches providing financial information about the costs of using an allotment.

	From survey responses		Average purchase or rental price of replacement forage per AUM for respondent ranches (varies by county of home ranch)				
A	B	C	D	E	F	G	H
	Average fee per AUM paid to Forest Service (does NOT include non-fee costs)	Average total cost of using allotment (includes ALL costs and fee)	Hay (does NOT include non-price costs)	Irrigated pasture based on crop reports (does NOT include non-rent costs)	Range pasture based on crop reports (does NOT include non-rent costs)	Irrigated pasture per expert advice: (does NOT include non-rent costs)	Range pasture per expert advice: (does NOT include non-rent costs)
i. Ranches providing cost data	$2.78[1] (n=7)	$41.30 (n=6)	$37.83 (n=7)	$25.01 (n=8)	$18.75 (n=8)	$19.50	$13.57
ii. Using Nevada prices				$16.29 (n=16)	$11.79 (n=16)		

[1]Includes fees for intermingled lands.

transportation costs would be higher. Comparability, however, is limited, because dry summer pasture in the summer is of low nutritional quality, and the costs of transportation, labor, and other factors are not included here for the forage alternatives (Table 6).

A common assumption is that owners of private land who lease it out fund improvements to their private land themselves. Surprisingly, respondents in this study report when they lease private land they often contribute both labor and materials for property improvements and maintenance (Table 7). Non-permittees were more likely to carry out brush removal on their summer leases, while permittees more often fenced Forest Service riparian areas. In general, whether agency or landowner, those renting out the property, paid the cost of improvements about half the time. Three quarters of all ranchers had fenced to improve distribution on the summer public or private lease. More than 28% of the non-permittees paid all the costs of the fencing, compared to 9% of the permittees. For most fence projects on Forest Service permits, the rancher provided the labor and the Forest Service the materials. Incorporating all these costs would bring up the cost of using the alternatives (Table 6, columns D through H).

However, the costs of using public grazing allotments are often reported to be higher than those for using pri-

Table 7. Range improvement practices on summer leased land, Central Sierra ranchers with and without Forest Service grazing allotments, 2000-2001.

Carried out the following practice on summer private lease or National Forest allotment in last 10 years:	% Permittees (n=23)	% Non-permittees (n=14)	χ^2
Fencing for distribution	78	71	ns
Fencing riparian areas	35	16	.04
Water development	35	29	ns
Seeding	13	7	ns
Brush removal	9	29	.04

Table 8. Costs associated with use of allotments or other leased land for Central Sierra ranchers with and without Forest Service grazing allotments, 2000-2001.

Forest Service permittees using allotment	Non-permittees using private or other lease
Transportation	Transportation
For animals	For animals
For labor	For labor
Wear and tear on the vehicles	
Gas	
Labor	Labor
Putting up and taking down fence annually	
Fence maintenance	Fence maintenance
Gathering	Working cattle
Looking after the animals and moving them	
Monitoring of the allotment	
High death loss	Fertilizer
Price of bells	Electricity
Special vaccines	Veterinary supplies
Vandalism	Supplemental feed
Move to allotment for the season	Mineral supplements
Groceries	Water
Cabin maintenance	
Dangerous	
"Hassle factor"	

vate leases in the grazing fee literature (Van Tassell and others 1997; USDA/USDI 1977), largely because of the kinds of costs listed in Table 8. Van Tassel and others (1997) found that in Idaho, New Mexico, and Wyoming, Forest Service allotment grazing costs were higher on average than costs for private land leases. It is important to note that in the Van Tassell study the private lease rate was an average of $7.71/AUM, significantly less than the average of $13.70/AUM for dry range and the $22.50/AUM for irrigated pasture actually paid by the ranchers in this study.

4. Full cost comparison

To get a better comparison of the actual costs of using allotment and alternative sources of forage, all the ranchers in the survey were asked to estimate the full costs of using their current source of summer forage (Table 9). The cost difference reported here ($15.85 versus $22.33) (Table 9) is comparable with that found in 1984 in California (Tittmann and Brownell 1984), considering the changing value of the dollar. It is also similar to that documented in the *Rangeland Reform Environmental Impact Statement of 1994* (USDI-BLM and USDA-USFS 1994).

This and other studies show that the costs of using alternative sources of forage vary a great deal from ranch to ranch (Fowler and others 1986) (Table 9). Uniform federal fees have different effects on each

Table 9. Total cost per AUM of using an allotment versus a private lease as estimated by permittees and non-permittees, 2000-2001.

	Total cost per AUM to use allotment estimated by permittees	Total cost per AUM to use private lease estimated by non-permittees
Average	$15.85	$22.33
Range	$10.00-$30.00	$18.00-$28.00
n	20	6

Table 10. Relative cost of Forest Service allotments versus private leases as estimated by Central Sierra ranchers with Forest Service grazing allotments, 2000.

	Allotment use costs more	Allotment use costs less	Comparable
Permittees (n=17)	12%	41%	47%

ranch (Fowler and others 1986). The full costs of using a piece of land are a function of region and site, including accessibility, topography, elevation, distance to base ranch, breed of cattle, labor costs, and so forth (Table 8). For similar, often intermingled lands, one corporate timber producer charged $4.50 per AUM in 1999, while the Forest Service charged $1.35 - a $3.15 difference per AUM for adjoining lands of similar characteristics and costs of use. However, the use of the corporate land is closely associated with the use of Forest Service land. Intermingled, one cannot be used absent the other.

5. Limitations of cost data

Other factors influence any evaluation of comparative costs. Differences in cost between private and public leases are capitalized into the value of western ranches as "permit value" (Torrell and Kincaid 1996). This differential underlies the value of the ranch, the loans available to the rancher, and the taxes paid by the rancher (Stern 1998) and was included in the Van Tassel calculations of relative costs (Van Tassel and others 1997). A sudden shift in fees would likely devalue the capital value of the ranch.

Losing forest allotments would also be disaffecting. Most ranchers enjoy the time they spend working in the mountains and tend not to factor the value of shared family labor into the costs of using an allotment.

Finally, permittees and non-permittees often com-

Table 11. Income statements for examples of small, medium and large Forest Service permittee ranches, 1999 (includes off ranch income).

	Small (n=4)	Small - Spent on allotment	Medium (n=4)	Medium - Spent on allotment	Large (n=2)	Large - Spent on allotment
Total ranch income	$84,363		$156,919		$288,424	
Total all costs	$95,020	$13,905	$157,670	$46,177	$271,819	$15,000
Net returns to ranch	$(10,657)		$(750)		$16,601	
Total income over total expenses	$(22,229)		$(1,198)		$12,766	
Percent of total costs from the allotment		15%		29%		6%

mented on the cost of interacting with a large, sometimes seemingly illogical or unresponsive bureaucracy. Though most felt they had a good relationship with the Forest Service and its personnel, coping with the agency's changing goals and practices, and the somewhat irregular changes in permitted times and amount of use documented in this study (pages 20 - 21), adds a cost not quantified here.

When asked which kind of a lease, Forest Service or private, cost more, most permittees opined that using Forest Service land cost less or was comparable to private leases (Table 10). Most non-permittees felt that the value of a ranch was lower if associated with a Forest Service lease, but four of ten permittees reported the value of their ranch was higher because they had a permit.

6. The financial role of the allotment

A balance sheet was created for a case study examination of the financial role of the allotment for examples of small (0-199 head), medium (200-499 head), and large (500 plus head) ranches (Table 11). The resulting balance sheets, from the relatively few ranches that completed the entire financial section, show how changes in summer lease costs affect each size category (Table 11). Table 11 implies that an increase in the summer lease rate might be least tolerable to small and medium ranchers. The allotments constitute the largest portion of the total costs of medium-sized ranches. The largest costs for all are feed, cattle purchase, and private range (Table 13).

Table 12. Cash flow of business for example permittee ranches in three size classes, 1999 (Does not include depreciation, interest, or off-ranch income.).

	Small (n=4)	Small - Spent on allotment	Medium (n=4)	Medium - Spent on allotment	Large (n=2)	Large - Spent on allotment
Total ranch income	$84,363		$156,919		$288,424	
Total costs (w/o depreciation or interest)	$88,638	$13,455	$132,178	$42,738	$239,384	$12,000
Net returns to ranch (cash flow, w/o depreciation or interest)	$(4,275)		$24,742		$49,040	
Percent of total costs from the allotment		15 %		32%		5%

Table 13. Major costs of example permittees in three size classes, 1999 (n varies from 1-4).

Costs:	Average cost small ranches (n=4)	% of total costs	Average cost medium ranches (n=4)	% of total costs	Average cost large ranches (n=2)	% of total costs
Private leases	$23,402	21%	$32,173	20%	$124,134	46%
Cattle purchase	$7,655	7%	$32,638	20%	$114,645	40%
Feed	$13,537	13%	$8,317	8%	$19,399	7%

A cash flow analysis (Table 12) eliminates depreciation and interest from the calculations and isolates the flow of funds into and out of the business over one year. Smaller ranches show negative net returns to the ranch side of the business. The medium ranches in this example, though not making a financial profit overall (Table 11) are bringing in enough money to cover their annual costs (Table 12). The large ranches are the only size class to make money in terms of net returns to ranch business, total income over total expenses, and cash flow.

When the Forest Service permittee small ranches are compared to the two non-permittee small ranches that completed the financial section, the non-permittees spend a larger percentage of their total costs on the summer lease. In comparison to the small permittee ranches, the small non-permittee ranches have higher net returns.

It has been well documented that ranchers ranch for reasons other than profit (Rowe and others 2001a; Liffmann and others 2000; Smith and Martin 1972). Frequently the ranching household supplements ranch income with other sources in order to continue enjoying the ranching lifestyle and traditions. This phenomenon has been noted throughout the West (Starrs 1998) and in Europe (Campos-Palacin and others 2002). The permit, and working up in the mountains, is one of the lifestyle benefits that provides incentive for ranchers to keep ranching.

Overall, using the cost differentials to evaluate the impact of a loss of grazing allotments on ranches in the Central Sierra is problematic. First, accounting for all costs is difficult, and some costs are hard to quantify. Second, the wide variation in the costs and availability of alternatives, and in the flexibility of livestock operations, makes generalizations based on an "average ranch" difficult. Finally, monetary profit is not a clear-cut predictor of the survival or persistence of ranches.

IV. What if a Grazing Permit is Reduced or Lost?

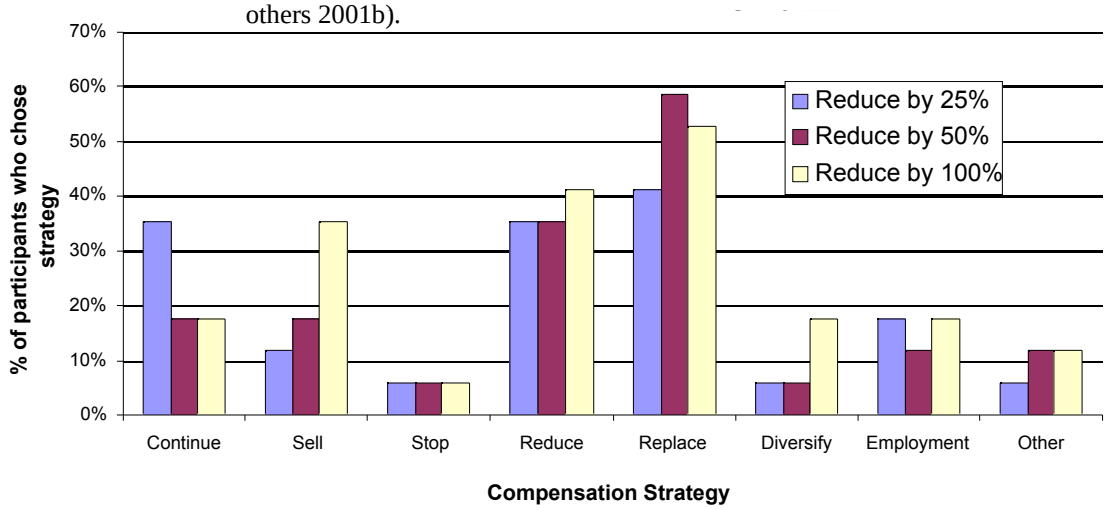
Ranchers with Forest Service permits were asked to outline their possible strategies to compensate for a reduction in permitted number of stock. The question asked was: "If the BLM or the USFS were to permanently decrease the allowable grazing by either 25%, 50%, or 100% on your permit(s), what would be your most likely response or responses?" Respondents could circle more than one response for each reduction level. The response options were:

1 **CONTINUE** ranching without change = You can continue your current operation without change.
2 **SELL** your ranch = You would sell all or part of your ranch. You might leave ranching altogether or buy a ranch elsewhere.
3 **STOP** ranching = You would hold on to the ranch but stop ranching. You might lease the ranch out to someone else.
4 **REDUCE** production = You would cut back on livestock production, reduce your herd.
5 **REPLACE** Forest Service forage with other forages = You would replace public forage loss with other forage sources, avoiding any reduction.
6 **DIVERSIFY** ranch production = You would diversify your ranch operation.
7 **EMPLOYMENT** off ranch = You would supplement your income by pursuing more or better paid off-ranch employment.

Most ranchers chose reduction in production and replacement of forage as the most popular solution for all the different reduction levels (Figure 2) (Sulak and Huntsinger 2002). With a 25% reduction many felt they could continue their business as they do now. Selling the ranch, while not the most popular solution for any reduction level, gains in importance as reductions increase in severity. Surprisingly, selling the ranch is more popular than diversification. More than a third of respondents marked selling the ranch as a strategy if the Forest Service stopped their grazing completely. Nevertheless, a majority indicated they would attempt to replace the forage or reduce the herd at the 100% Forest Service reduction level. Rowe and others (2001b) found similar results among permittees in Colorado.

When asked to describe in more detail the strategies they would use to cope with reductions in permitted grazing, most stated they would look for more forage to replace that lost. Plans for finding another allotment or private ground were mentioned, though some respondents specifically highlighted the difficulty of finding private forage. Overall the changes resulting from a 25% reduction were not severe (Figure 2). The strategies outlined in response to 50% and 100% reductions were similar and more severe, which implies that the 50% reduction level might be a threshold after which using the allotment is not practical for many

Figure 2. What permittees say they would do if the Forest Service was to reduce permitted grazing by 25, 50, or 100 percent (n=23) (adapted from Rowe and others 2001b).



ranchers. Ranchers indicated that for many of them this threshold is the balancing point between the costs of and income from using the allotment. One participant explained that at a 25% reduction he could still justify the expense of using the allotment, and would find replacement forage for the extra animals. Another responded that when using Forest Service summer range, ranchers are not able to supplement their income with off-ranch employment because they need to be able to go up and work the cattle in the mountains. If they continue using mountain range, potential compensation with off-ranch income is limited and at a certain point using the allotment is no longer economically possible.

One respondent discussed diversification as a possible coping method at the 100% reduction level. The rancher listed ideas such as new crops or on-ranch vacation marketing, but also described all the difficulties with those options (insurance, land use regulations, large initial capital outlay). With a 50% reduction, another mentioned that he might be able to sustain the ranch by grazing down the private land a little farther. A rancher that leases out forage to other ranchers said that he would have to lease out less and less of that land to others as reductions moved from 25% to 100% on the Forest Service allotment. He stated that this loss of income would leave the ranch with no money for improvements such as controlling yellow star thistle.

A complication apparent in some of these scenarios is the intermingling of private land and other public land with Forest Service land. Leaving the Forest Service land ungrazed while continuing to graze intermixed land would in some cases be impossible. At the 100% reduction level, more than one respondent mentioned selling and/or subdividing the private land he owned within the allotment boundaries as a way to gain some income. Another rancher mentioned a private lease associated with the Forest Service range and answered that her response would be dependent on the actions of the private landowner that leased her the intermingled property.

Permittees were asked "How well do you think your strategies would compensate for public forage loss?" and were given a choice of three possible responses. Of the eight that answered the question, most felt that their strategies to compensate for a loss in Forest Service forage would lead to a net loss in income. However, two ranchers felt they could make more money without the allotment, and one felt he would lose money initially, but after a few years could regain present status.

1. What ranchers say they will do

Participants were asked what they might do on their private land in response to permit reductions. Selling the ranch was believed an undesirable outcome (Table 14). If they sold, interviewees said they would prefer either to sell the entire ranch and move to ranch elsewhere, or sell part of the ranch and continue to ranch. Most respondents do not intend to sell their ranch, but are committed to their land and to ranching. Similar responses have been found in state and countywide surveys of California ranchers (Liffmann and others 2000)

Respondents indicated the likelihood of various actions on their private land at an unspecified future time

Table 14. Likelihood of Central Sierra Forest Service permittees selling all or part of the ranch in response to Forest Service forage reductions, 2000.

What is the likelihood you will do this as a result of reductions in grazing? (n=9-10)	Very Unlikely	Somewhat Likely	More Likely	Very Likely	Not Possible
Sell the ranch - leave ranching entirely	70%	30%	0	0	0
Sell the ranch - buy a ranch elsewhere	44%	33%	22%	0	0
Sell part of the ranch - continue ranching	50%	30%	10%	10%	0
Sell part of the ranch - discontinue ranching	55%	44%	0	0	0

(Table 15). The actions most often stated to be more or highly likely by permittees were leasing more private land and investing in range improvements. A number of respondents indicated a likelihood of transferring livestock from the allotment to existing excess private forage, and improving pasture. No permittees rated converting cropland to pasture, acquiring state land leases, selling seed stock or replacement heifers, or farming different crops on private land as more or highly likely. Many believed such strategies were impossible for them. The interest in leasing and improvements (Table 15) could be interpreted to mean that permittees are anticipating the possibility of losing the allotment by seeking alternative forage or planning to do so. Or it could mean that they are planning to increase herd size or reduce stocking rate. Many have in fact increased stocking rate in recent years (Table 16).

2. What ranchers have done

Ranchers were asked whether or not they had carried out these actions on their ranch or in their business during the past five years. The majority of the actions listed were not done by many permittee participants (Table 16). Overall, permittees have worked to improve the productivity of their private land, and seem to think they will need to carry more head on their land. The only actions that participants took in large numbers were leasing more private land, improving existing pasture, and investing in range improvements on their land (Table 16). Half indicated that they had increased stocking rate on private land. Not a single respondent reported converting cropland to pasture, acquiring state land leases, providing fishing for a fee, or selling a conservation easement on their land. For comparison, three of five non-permittees responding to the question had placed a conservation easement on all or part of their land in the last five years.

Table 15. Likelihood of permittees pursuing selected activities in the future, 2000 (choice of "highly likely," "more likely," "unlikely," or "not possible").

Will you do the following in the near future?	# permittees who answered "more" or "highly likely":	# permittees who answered "impossible":
Lease more private land (n=14)	9	0
Invest in range improvements on private land (n=15)	7	0
Transfer stock to excess private forage (n=15)	6	3
Improve existing pasture (n=15)	4	0
Provide hunting for a fee (n=9)	3	2
Increase existing diversification enterprise (n=5)	2	0
Offer on-ranch vacation (n=9)	2	1
Produce value added beef on your private land (n=9)	2	0
Provide fishing for a fee (n=9)	2	3
Buy more private land (n=15)	2	0
Acquire more federal allotments (n=15)	2	2
Increase stocking rate on private land (n=15)	2	2
Sell meat directly to consumers (n=9)	1	1
Add a different kind of livestock (n=9)	1	1
Add new agricultural enterprises (n=9)	1	1
Switch to a different class of livestock (n=9)	1	1
Sell a conservation easement (n=10)	1	1
Farm different crops (n=8)	0	2
Sell seed stock or replacement heifers (n=8)	0	1
Convert cropland to pasture n=(14)	0	7
Acquire state land lease (n=15)	0	3

Table 16. Activities pursued by permittees during the last 5 years, 2000.

The following were carried out by permittees over the past 5 years (n=17-19):	Number of permittees who answered yes:
Invested in range improvements on private land	18
Improved existing pasture	12
Leased more private land	12
Increased stocking rate on private land	9
Bought more private land	6
Transferred livestock from allotment to excess private forage	5
Increased existing diversification enterprise	5
Sold meat directly to consumers	4
Added more production to ranch through new agricultural enterprises	3
Inherited land	3
Added a different kind of livestock	3
Sold seed stock or replacement heifers	3
Acquired more federal allotments	2
Switched to a different class of livestock	2
Offered on-ranch vacation	1
Provide hunting for a fee	1
Farmed different crops	1
Produced value-added beef product for higher return	1
Converted cropland to pasture	0
Acquired state land lease	0
Provided fishing for a fee	0
Sold a conservation easement	0

Four ranchers who had given up a Forest Service allotment on the El Dorado National Forest were interviewed about why they stopped grazing the allotment and how they compensated. The permits were given up in 1955, 1964, 1987, and 1997. Two of the ranches said a death in the family was the cause, because the allotment then required too much work for those left behind compounded by the added costs of estate disagreements. Other reasons given were increases in Sierra Pacific Industry fees, increased regulations for such things as riparian fencing, loss of feed between the home ranch and mountains for the cattle drive, and loss of the private land lease associated with the allotment.

The compensation strategies used by the four former permittees were similar to those proposed by current permittees. Two purchased more land, one outside of California. The third reported that giving up the allotment did not increase costs, though he now had to ship cattle out of state and was becoming concerned that it was going to become more expensive. The fourth reported reducing cattle numbers to save money on leases. There was no opportunity to interview ranchers whose compensation strategy failed. In a study of twelve former permit holders on the Shasta Trinity National Forest, 60% leased more land after giving up the permit and two went out of the business (Forero 2002).

V. Ranching and the Foothills of the Future

Reductions in grazing on Forest Service lands affect non-permittees and permittees by increasing competition for summer leases. Reductions in ranching activity or forage supply affect services and infrastructure available to the entire ranching community (Hart 1986; Huntsinger and Hopkinson 1996). Permittees are the most directly influenced, however, and there is evidence that permittees tend to be different in their history, motives for ranching, and in their vulnerability to changes in policy and land use. Understanding these factors can improve landscape scale conservation strategies, given continued change in federal policy and management.

1. Leased land as a source of forage

Leasing additional land for grazing is regarded by ranchers in this study as an important way to cope with needs for forage in summer and other seasons. It is common practice, and was used by two of the four ranchers interviewed who lost permits and stayed in business. Most ranchers say that leasing more land is their preferred way of coping with Forest Service reductions in grazing. However, interviewees commented that private leased land is in limited supply. In addition, the removal of one source of summer forage – Forest Service grazing allotments – could increase competition for summer leases for all types of ranchers.

All but 15% of ranchers leased forage from private owners. Only one interviewee did not lease any land, and all but two of the non-permittees used some leased land all year. Non-permittees leased an average of 5,709 acres. A third of non-permittees leased some non-federal public land. Those using Forest Service allotments reported that the allotments and lands associated with them—mostly forested lands of private timber companies—averaged around 30,000 acres. Although herd size was very similar, the average amount of private land owned by permittees was 1,710 acres, compared to 3000 acres for non-permittees (Table 1), an indication of the significant forage contribution from allotment lands. Interestingly, the difference, about 40%, corresponds with the contribution of the allotment to the operation estimated by permittees.

Frequently private leases are rented year round and the lessor regulates time and amount of use within agreed -upon parameters. Some interviewees reported using seven to ten different leases (not including Forest Service allotments) to supply year round forage for the herd. A few of the private leases are “lease-back” arrangements where the rancher sold the land and will lease it back until the landowner develops it or sells to someone who will. These agreements can be legally binding for a certain prescribed number of years, or less formal and more uncertain. A small number of ranchers reported leasing land from the family trust, potentially reducing the rent reported by these ranches. The most common non-federal public lessor is the East Bay Municipal Utility District, with both permittees and non-permittees leasing from it.

Irrigated pasture can provide an excellent source of green feed in the summer. As one might expect, non-permittees more often use it, with 23% of non-permittees and 5% of permittees reporting use of irrigated pasture in the fall ($p<.09$). Unfortunately, a sharp decline in irrigated pasture in the Sierra foothills and statewide has been documented, as irrigated lands are converted to viticulture and other forms of intensive agriculture, or developed for housing and golf courses (Ewing and others 1988).

2. Forest Service allotment management affects permittee management of private ground

Having an allotment shapes the pattern of ranch production. More than 83% of permittees have herds that follow the transhumance-based pattern of calving in the fall, compared to 69% of non-permittees. To use a Forest Service allotment, calves need to be either weaned or, more commonly, large enough to handle wildland conditions, before the herd is moved onto mountainous Forest Service rangeland in the summer. In comparison, non-permittees using pasture or foothill range in the summer are less restricted to a fall calving season.

Fluctuations in federal policy for grazing strongly affect the permittee ranches. Forest Service permittees experience more frequent changes in the conditions of

their leases, and feel more vulnerable to national policies and regulation. About half, 52%, of permittees reported that there have been changes in the kinds or number of animals on their allotment over time. About a third of non-permittees reported that on their non-Forest Service leases, the numbers or kinds of animals grazed changed but, in almost all cases, at the decision of the lessee. Some 44% of permittees reported that on and off dates for their allotments change frequently. A third of permittees stated these dates varied 7 to 10 days, a fifth 7 to 14 days, and a sixth more than two weeks. Changes in on and off dates mean that a rancher may need to keep the herd on lowland range longer, or take them off the mountains and onto fall pastures, earlier than anticipated. Fortunately, on dates are most likely to be pushed back in a wet year when forage is more plentiful in the hills. By contrast, more than 78% of non-permittees reported that the on and off dates for their private leases did not generally change at all.

Residual dry matter (RDM) management systems specify levels of dry forage to be left ungrazed at the end of the year to foster the germination of beneficial species and to protect the soil. It is recommended for annual grassland range like that of the foothills in California. Half of the non-permittees used the RDM method as a way of managing grazing, but none of the permittees reported that they used this management technique on their private land ($p<.00$). The Forest Service uses RDM as a tool for monitoring their allotments, so permittees are aware of it, and a majority are required to use it on the allotment. More than 87% of permittees reported that they were required to implement some sort of grazing system on the Forest Service allotment. One reason why permittees did not use RDM standards on their private ground may be because permittees did not use annual range in the summer, when residual dry matter management is most crucial. Additionally, the dates permittees arrived and left their foothill pastures were mostly determined by Forest Service stipulations for the montane allotment, not RDM on the foothill lands. About half of the non-permittees, as compared to a third of permittees, used some form of grazing system on their land, mostly a rotation-type system.

Ranchers were asked what kinds of changes or pressures limited their use of summer leased land. All ranchers said that livestock prices and production costs were particularly influential (Table 17). The Endangered Species Act, regulation, vegetation change, agency policy, family considerations, and conflicts with other land users were more important to permittees than non-permittees. Although 43% of all ranchers reported that development of surrounding land was an “important” influence, only around 13% stated it was “highly important” (Table 17).

More than 90% of both permittees and non-permittees reported that they were satisfied with range conditions on their own private ground, but permittees seem to engage in range improvement practices on their private ground more often than non-permittees. More than

Table 17. Factors that affect a rancher’s ability to use summer leased land: permittees vs. non-permittees, 2000 and 2001 (choice of: “not important,” “somewhat important,, ” “more important,” and “highly important”).

The following have a “highly important” affect on rancher ability to use summer leased land:	% Permittees (n=23)	% Non-Permittees (n=14)	χ^2
Regulations	87	14	.00
Production costs	74	57	ns
Livestock prices	74	64	ns
Family considerations	70	21	.01
Endangered species	61	14	.01
Changes in vegetation	52	14	.04
Agency policy	44	7	.04
Conflicts with other land users	44	7	.00
Technological change	17	7	ns
Development of surrounding land	13	14	ns
Relations with non-USFS lessor	Not asked	57	

Table 18. Ranch management practices of Central Sierra ranchers with and without Forest Service grazing allotments, 2000 and 2001.

Rancher has done the following on private ranch property:	% Permittees (n=23)	% Non-permittees (n=14)	χ^2
Develop water	74	54	ns
Fence for distribution	70	79	ns
Build and maintain roads	61	43	.20
Remove brush	61	31	.08
Seed	44	36	ns
Prescribe burn	35	21	ns
Implement a grazing system	35	50	ns
Apply fertilizer	35	36	ns
Fence riparian areas	13	7	ns

a third of all ranchers have done some seeding and/or fertilization, and about a quarter have done some burning, but permittees were more likely to have carried out water developments or removed brush (Table 18). The majority of ranchers have built fences to improve animal distribution, but few in either group have fenced riparian areas on private ground (Table 18). When ranchers were asked if vegetation change had led to changes in their operation, more than three times as many permittees said "yes" compared to non–permittees. Under Forest Service guidance, permittees were less likely to remove brush and more likely to fence riparian areas on summer range (Table 7).

When asked about important influences on their whole operation, as one could expect, permittees more often reported that regulations had an effect on their management decisions in general (Table 19), as did relations with other public land users, endangered species, and agency policies.

3. To ranch or not to ranch

Permittees were much more likely to say that development of surrounding land affected their general operations (Table 19). This might be because they also have been in the area longer (Table 20) or because movement up to mountain pastures is constrained by development. Development was reported as an important factor affecting the ability of 43% of all ranch-

Table 19. Influences on Central Sierra ranchers with and without Forest Service grazing allotments, 2000 and 2001 (choice of: "not important," "somewhat important,, " "more important," and "highly important").

The following are "highly important" to rancher management goals, decisions, and practices:	% Permittees (n=23)	% Non-permittees (n=14)	χ^2
Regulations	70	14	.02
Agency policies	65	0	.00
Endangered species	48	7	.02
Conflicts with other public land users	30	15	.2
Relations with a non-USFS lessor	Not asked	43	
Livestock prices	87	79	ns
Production costs	83	79	ns
Development of surrounding land	65	31	.05
Family considerations	61	50	ns

ers to use their allotments and summer leased land. Development of housing and urban areas, and the increasing numbers of vehicles on the roads, has made traditional cattle drives almost extinct. Foothill roads are frequently main commuter thoroughfares, and may also be heavily used by recreational users.

Encroaching development and land use change caused problems for about three-quarters of all ranchers, and nearly half of all ranchers reported currently experiencing land use conflicts with non-ranchers. A third of all ranchers felt that the conversion of nearby ranches to other non-livestock uses had an important influence on their ranch goals, decisions and practices. The conversion of nearby ranches to other uses was stated to be an important factor when considering the possibility of selling the ranch (Table 21).

Only one rancher in the study claimed livestock prices failed to influence decisions, and all ranchers agreed that production costs were important. Almost all ranchers had heard of diversification as a way to increase profits, and about half had made an effort to diversify, though this was not apparent in their answers (Table 15 and Figure 2). More than half of all respondents had a member of the family working off the ranch. When asked about the degree of financial stress experienced by ranchers over the last five years, permittees were the more stressed, with 35% saying they were under severe stress financially compared to 14% of non-permittees.

Most permittees began ranching in the area before 1900 (Table 20). About three-fourths of ranches with permits have remained in the same family for more than 100 years. This indicates a decided stability in these permittee ranch ownerships. Forest Service grazing permits were allocated early in the twentieth century and therefore those purchasing or creating ranches since then find it more difficult to secure a permit. Both Hargreave (1993) and Johnson (1998) argue, based on small scale studies, that Forest Service permittees are among the oldest and most resistant to development. Although the great majority of ranchers reported needing help for annual activities like branding calves, permittees were more likely to rely on family, neighbors, and volunteers, considered a traditional ranch and pastoral practice, while non-permittees more often hired help.

Non-permittees were more likely to report management goals that had changed over time (Table 20), though almost all ranchers reported changed practices. The two goals most important in discussions with permittees were sustaining the lifestyle, and managing the ranch well so that it can be passed on to heirs. Lifestyle was also mentioned frequently as a goal by non-permittees, but passing the ranch on to heirs was not. Many ranchers in both groups expressed the straightforward goals of staying in business and not losing money. Quite a few of them mentioned that producing good quality meat was their main goal. Many non-permittees talked of efficiency, and producing as much beef as they could. One permittee discussed the newer generation's interest in a more holistic approach to ranching, and a non-permittee mentioned ranching with a goal of balancing agriculture and nature. A few of older ranchers, permittees and not, talked of ranching as a hobby. For them, the goal was a retirement enjoying the ranch they worked for many years to create.

Table 20. Similarities and differences between Central Sierra ranchers with and without Forest Service grazing allotments, 2000 and 2001.

The interviewee:	% Permittees (n=23)	% Non-permittees (n=14)	χ^2
Began ranching in the area before 1900 or before	74	43	.06
Needs help to brand calves	91	100	ns
Uses hired help	26	43	ns
Has changed management practices over time	91	86	ns
Has had management affected by vegetation change	74	21	.00
Has changed management goals over time	35	54	ns

Ranch practices have also changed over time and, not surprisingly, have become more sophisticated. Permittees and non-permittees talked of targeting breeding and genetics programs specifically to customer demand. Some permittees talked of choosing their bulls to increasingly specific criteria, and improving equipment and veterinary care. A few non-permittees and one permittee used the Internet to sell cattle and market other products. The most frequently mentioned change in practice for permittees is the change to trucking from herding cattle to the mountains on horseback.

When asked if they had plans to sell their ranches, 91% of permittees and 71% of non-permittees answered "no." Three of four respondents believe ranching can be saved in their area. Consistent with a number of other studies in California, approximately 70% of all ranchers had their ranches enrolled in the California Land Conservation Act (Holzman 1993; Huntsinger and others 1997). More commonly known as the Williamson Act, the 1965 Act provides tax relief to those who sign a ten-year rolling contract committing the land to agricultural use. All ranchers had heard of conservation easements, and half said they would consider one. Two-thirds of all ranchers reported that they had inherited their ranch. Roughly twice as many permittees as non-permittees stated that inheritance taxes had been a problem for them at some point (30% compared to 15%); the difference probably stemming from their longer history of family ownership in general. More than two-thirds of all ranchers had done estate planning.

When asked which was more important to them, the location of their ranch in the foothills, or ranching as a business and way of life, a majority of permittees and non-permittees said that they valued them equally However, of those that did choose, almost a third, 29%, of non-permittees reported they valued the "location" the most, compared to only 9% of the permittees.

More than 60% of permittees, compared to 21% of non-permittees, said that it was highly likely that a family member would take over the ranch someday. Most ranchers felt that having nobody to pass the ranch on to, failure to make a profit, land use conflicts, or increasing regulation, would be important reasons to sell the ranch (Table 21). In fact permittees and non-permittees felt alike about land use change factors. Permittees, however, were more concerned about changes in the community and land use conflicts with non-ranchers (Table 21).

4. Permittees have some different goals

When asked about their reasons for ranching, in general the answers follow the patterns reported in a number of other studies (Bartlett and others 1989; Liffmann and others 2000; Rowe and others 2001; Gentner and Tanaka, 2002) with an important difference: on some measures, ranchers without permits are different than ranchers with permits (Table 22). Previous studies have not always distinguished or included ranchers without public land grazing permits.

Table 21. Reasons to sell the ranch, Central Sierra ranchers with and without Forest Service grazing allotments, 2000-2001 (choice of: "not important," "somewhat important,, " "more important," and "highly important").

The following are "highly important" factors in a decision to sell the ranch:	% Permittees (n=23)	% Non-permittees (n=14)	χ^2
Increase in public policy regulations	46	30	ns
Ranching not profitable	39	46	ns
No one to pass ranch on to	39	23	ns
Unhappy with the way the community is changing	39	8	.07
Conversion of nearby ranches	27	15	ns
Land use conflicts with non-ranchers	26	0	.04
Increase in property value	18	15	ns
Retirement	9	8	ns
Society no longer appreciates ranching	9	0	ns

Table 22. Important reasons to ranch, Central Sierra ranchers with and without Forest Service grazing allotments, 2000-2001 (choice of: "not important," "somewhat important,, " "more important," and "highly important").

The following are "highly important" to my decision to engage in ranching:	% Permittees (n=23)	% Non-Permittees (n=14)	χ^2
Enjoy the ranching way of life	96	86	ns
Consistent with my traditions, culture, and values	96	71	.04
A good place to raise my family	91	79	.27
Part of our western heritage and should be preserved	91	57	.01
Enjoy animal husbandry	87	64	.1
Allows me independence	87	57	.04
Allows me to live closer to my family	87	50	.01
Like ranch work	87	43	.00
Like to live near natural beauty	86	71	ns
Ranch has been in my family for generations and I maintain it to carry out that tradition	74	39	.04
Makes me feel close to the earth	65	43	.18
Want to pass the business on to my children	65	36	.08
Can live closer to my friends	23	21	ns
A good way to make money	9	7	ns
Dificult to get a job outside the ranch	9	7	ns

The majority of ranchers report that culture, family, lifestyle, and natural beauty are highly important to them (Table 22). Ranching allows them to feel "closer to the earth," as 91% of permittees and 79% of non-permittees report (Table 22). Less compelling is the money-making potential of the operation, which by all accounts is a realistic assessment. Most feel that it would not be difficult to get a job off of the ranch. Ranchers continue in ranching not because it is their only possible occupation but because they choose it. The permittees are more likely to express an interest in preserving the ranch for the future. Ranching, they believe, should be preserved as part of family and western tradition. It allows them to live closer to family, and overall they like ranch work. More than 65% of permittees thought having a business to pass on to their children was a "highly important" reason to ranch, compared to 36% of non-permittees.

Table 23. How declining ranch numbers have affected permittees and non-permittees, 2000-2001 (choice of: "not affected" "somewhat affected," "affected more," and "highly affected").

The following result of a decline in neighboring ranches has highly affected me:	% Permittees (n=23)	% Non-permittees (n=14)	χ^2
Harder to resolve land use conflicts	49	72	.03
Less of a common identity	38	36	ns
Feel less like part of a community	23	36	ns
Less availability of labor	24	7	.07
Fewer neighbors for volunteer help	19	0	.14
Fewer commercial ranching services	33	7	.08

Table 24. Rank of factors that ranchers think will affect them more in the next five years, permittees and non-permittees, 2000 and 2001, ranked on a scale of 1 (highest impact) to 7 (lowest impact).

Ranked by permittees (n=19)	Ranked by non-permittees (n=14)
Water quality restrictions--3.47	Water rights issues--3.00
Endangered species issues--3.68	Water quality restriction--3.14
Development pressure--3.79	Taxes--3.50
Competing uses--4.37	Development pressure--3.79
Wildlife management--4.42	Endangered species issues--4.64
Water rights issues--5.21	Competing use--5.21
Taxes--5.42	Wildlife management--5.93

Ranchers noted the sale of an average of eight nearby ranches in the last ten years, and stated that about a quarter of those ranches remained as ranches. They were then asked how the decline in the number of ranches in their area had affected them (Table 23). Permittees feel the effects of fewer neighbors volunteering to help more strongly than non-permittees. All ranchers feel the loss of identity and community. Non-permittees, however, seem to be more troubled with land use conflicts. Around three-quarters (73%) of all the ranchers stated that they participate in land use planning efforts in their area.

Respondents were asked to rank the kinds of things that they think will most affect their ranching operation over the next five years, from 1 as "most important" to 7 as "least important" (Table 24). Permittees ranked endangered species and competing uses as more important, and non-permittees ranked water rights and taxes as greater concerns. Water quality restrictions and development pressures were ranked as important by all. Unfortunately, pressures such as global markets and rising production costs were not given as options to rank for this question.

VI. Conclusions

Central Sierra Nevada ranchers have much in common, though permittees and non-permittees are different in important ways. Grazing allotments and summer forage play an important role in ranch economics, and permittees believe that allotments help make their operations viable. If ranchers were to lose an allotment, their first choice would be to lease land for summer forage, but ranchers report that land for leasing is in short supply in the Central Sierra. Though answers indicate a strong desire to continue ranching, up to a third of permittees say they would seriously consider selling their ranch if they lose their allotment. Permittees overall have been on the land longer, and are more focused on keeping the ranch going and in the family, than are ranchers without Forest Service grazing permits. They also appear to be more vulnerable to policy and land use change.

1. Ranchers have a lot in common

The typical Central Sierra rancher is middle aged, with a cow-calf herd that calves in fall. Range forage is preferred as the primary source of feed for the herd, and the rancher is concerned about having a year round forage supply. Some hay is fed when forage is short, most often during late summer or fall. The ranch will typically lease grazing land from private and public ownerships to supplement what is available on the home ranch, preferably close by to reduce transportation costs. The rancher is greatly concerned about costs of production and livestock prices, and often must supplement ranch income with off-ranch sources. In many cases, the rancher has made some effort to diversify income sources, but does not see diversification as a way to replace lost forage resources. The rancher values the ranching way of life very highly, enough to forgo investing the money and ranch labor elsewhere. The average number of brood cows run by these ranchers is close to what has been considered the minimum viable ranch size of 300 head by prominent ranch economists (Workman 1986), though this number is probably lower than it should be today.

However, permittees and non-permittees are different in some ways. Ranches that have Forest Service grazing permits have been in their location longer, and have been in the ownership of one family longer, than those without. After the National Forests were created around the turn of the century, grazing permits were given out to local ranches to allow them to continue their traditional grazing use of montane range under Forest Service control. In general, permittee ranches are more concerned about maintaining the ranch so that their children can continue ranching. Over time, rancher management goals have not changed much, though practices and patterns have, in response to Forest Service policy and land use changes. They are concerned with how the community is changing, more often believe that land use change has influenced their ability to ranch, and more commonly report that they are financially stressed.

2. The allotment is important to the rancher

Ranches with permits use their allotments for summer green feed that is unavailable on the lower elevation woodland home ranch, and believe that the allotment is important to the profitability of the ranch. The allotment provides a significant proportion of the forage, and forage of good quality, to the ranch. Various forms of analysis, and the opinions of the ranchers themselves, indicate that allotments and grazing permits add value to the ranch, because they often cost less than the alternatives, though this varies from ranch to ranch. Some of this benefit is mitigated by a lack of stability in forage availability, as Forest Service dates of use and allowable stocking rates vary much more than those for private leases. The cost of this growing uncertainty in permit use, and undervaluation of personal and family labor, further reduces the difference in cost between private and public leases, but is not quantified here. Another cost unquantified here is the cost of changing to new pastures and even a different cycle of production.

The size and configuration of private ranches has been shaped by permit possession. Although both permittees and non-permittees in this study had similar average herd sizes, the permittees owned roughly half as much acreage.

The constraints and availability of the Forest Service allotment shape permittee management of non-allotment land and the herd. Those with permits are less likely to state that they employ a grazing management system on their own land, perhaps because the Forest

Service stipulates the timing and availability of the summer range, and the system used on it. Those with private summer range reported brush removal as an important range management activity on that range, while those with federal summer range reported brush encroachment as an important problem on the allotment.

3. How will ranchers cope if they lose an allotment?

Both permittees and non-permittees believe that 40 to 50% of the profitability of the ranch is linked to access to summer range. Confining and feeding a cow-calf herd for any length of time is generally expensive and introduces a number of herd management issues and costs to the ranch that the typical range-based rancher is ill-equipped to handle. Disease is more easily spread, waste management facilities for a more concentrated herd must be developed, and animal behavior problems can be costly. Traditional practice relies on keeping animals dispersed on the landscape. It follows then that the rancher's highly preferred way of coping with the loss of an allotment is to lease more rangeland to replace it. Failing that, most believe they would reduce herd size. Most permittees believe that either option would lose income for the ranch. If the allotment was completely lost, third of ranchers stated that they would seriously consider selling the ranch, though few would consider doing so otherwise.

4. What ranchers have done

Permittees have been actively engaged in enhancing their forage supplies in recent years. A third have purchased more land, and about two-thirds have increased the amount of land they lease. Most plan to lease even more land in the future, even without a change in allotment access. The vast majority has carried out some form of range improvement recently, commonly including pasture improvement, and about half planned to carry out further improvements. About half had increased stocking rates on their own land in the last five years, and expect they will need to continue to do so. Four ranchers who had given up or lost allotments, yet stayed in business, either found replacement forage or leased additional land to replace the allotment. A study recently completed in Northern California interviewed numerous ranchers who had lost or surrendered a Forest Service grazing permit, and found that 60% leased more land to compensate (Forero 2002). Nearly two-thirds of permittees in this study have increased the amount of private land they lease within the last five years.

5. Leasing land as a source of forage

There are reasons to believe that leasing land will be difficult over the long term, particularly if there is a rapid increase in demand. In the entire study, there was only one rancher who did not lease land, and the costs of private leases are already one of the major costs of production for ranchers in the Central Sierra. On the average, private lease rates in the area are high, nearly twice that reported in a recent study in Idaho, New Mexico, and Wyoming (Van Tassel and others 1997). Some permittees reported needing 7-10 different leases to make it through the year. Interviewees commented on the intense competition for land, and one stated that traditional taboos against overt competition for leases were breaking down, with ranchers going "behind the back" of other ranchers to lessors in an effort to outbid them. On average, non-permittees lease more than five thousand acres each.

Another indication of the high demand for leases is that lessors in the Central Sierra appear to get an unusual amount of investment in their land from lessees. Lessees report they commonly contribute both labor and materials for fencing and other improvements on private leases. That demand is growing is indicated by the more than half of permittees who stated that they have increased the amount of land they lease in the last five years, and said it was more or highly likely that they would lease additional land in the future.

6. Effects of development and policy change: implications for conservation

Ranchers are active stewards of their land, highly value the ranching lifestyle and the environment, and express little interest in selling their land. More than three-fourths of all ranchers in the study believe that it is possible for ranching to continue in the Central Sierra.

Ranches with Forest Service permits are more focused on permanency and family continuity. That is not to say that some non-permittees are not as or more committed to permanency, it is just that this commitment is more prevalent in the permittee population. As the non-

permittee sample was selected from ranches of similar herd sizes to those of the permittees, the non-permittee population is also much more varied than that represented in this study.

That said, permittee ranchers are often worried about the way the community is changing, they tend to be financially stressed, and indications are that the loss of a Forest Service allotment would increase their costs. The possession of an allotment, however, is by no means an ideal forage resource for them. Vegetation and policy changes, and instability of management parameters, make the allotment an "unstable" resource. Subject to the changing goals of the public and the agency, allotment grazing resources are by no means assured from year to year. Because use patterns and practices have often been shaped by more than a hundred years of ranching in the same locale, permittees have also been the most profoundly influenced by land use change.

Ranchers are not strongly motivated by profit alone, but they obviously have financial limits. Ranches are often subsidized by off-ranch income sources. Smith and Martin (1972), studying Arizona ranchers in the late sixties, described ranches as a "unit of consumption," rather than production, maintained by their owners for the lifestyle, heritage, and contact with nature that ranching offers. Today, it is becoming recognized that ranching offers benefits to society that extend beyond those to the ranching family. When the techniques and resources are available, and the rancher perceives environmental quality as a benefit to the ranching lifestyle, the extensive ranch can conserve wildlife habitat, diverse plant communities, carbon-sequestration processes, and viewshed. The range-based operation is amenable to the production of the organic and "natural" products that are growing in popularity.

In the U.S., conservation easements are an incentive-based means of protecting private lands from development. While some non-permittees had conservation easements on their land, none of the permittees did. This may be attributable to the lack of stability ranchers face with the unknown future of federal permits. The amount and timing of grazing permitted on federal lands has changed greatly over time, declining by more than 90% since 1920 in a recent study in northern California where documented use was evaluated thoroughly (Forero, 2002). The recent Sierra Nevada Framework, a document framing Forest Service policy in the near future, estimates further grazing reductions of about 20% in the area. One question those interested in ranch land conservation should address is: ***How can the need for a stable forage supply be leveraged for ranchland conservation?***

An example of leveraging forage supply is the Malpai Borderlands Group located at the juncture of the states of New Mexico, Arizona, and U.S. border with Mexico (Daggett and Dussard 1998). The Group has established a grass bank that provides drought year forage and replacement forage to ranchers who want to carry out prescribed burning or range restoration on their land. In exchange these ranchers give up their development rights. It has been suggested that vacant Forest Service allotments in the Sierra Nevada, or other preserve lands where occasional grazing would fit management goals, could be used as grass banks in a similar manner.

While demand and interest in direct marketing of agricultural products and in specialty and regional products has grown, the ability of the range livestock producer to take advantage of this demand has been reduced in California. The infrastructure for marketing California beef - packing houses and auction yards - has been severely reduced. Ranchers cannot sell meat that has not been packed in a federally inspected packing house, yet these are increasingly few and expensive to reach. Local range produced beef can easily accommodate the values of many Californians - land conservation, low use of chemicals, specialty products, and humane production practices. Therefore another question that could be addressed by those interested in ranchland conservation is***: How can the full value (to society and the purchaser) of range-produced, local beef be realized by the range producer?***

There are a few examples of value added beef selling for higher prices reflecting the environmental values included in the price of the beef. In Yampa, Colorado, the Yampa Valley Beef Company markets beef from local ranches to the Steamboat Springs resort market. This program guarantees that 25% of the beef comes from ranches with conservation easements and is able to receive a higher price for their product. There is at least one program in the Sierra foothills which would

emulate the Yampa Valley project. Along the same lines is the Nature Conservancy's Conservation Beef program.

In addition to the loss of infrastructure, land use conversion, demographic change, and community attitudes and goals are influencing the ability of ranchers to carry out their traditional practices. Most ranchers still rely on neighbors and volunteers with livestock handling skills to carry out aspects of their operations, and when ranches disappear, so does the labor pool. A reduction in the number of ranches also affects local infrastructure, such as veterinarians, and feed and supply stores. A final question might be: ***How can the needs of agriculture, particularly extensive ranching, be incorporated into local and county planning?***

7. Some Ideas and Recommendations

Conserving the working landscapes of the Central Sierra calls for coordination among state and federal agencies, local conservancies, local governments, ranchers, communities, and others who want to protect working landscapes in the Sierra. There are potential opportunities to augment ranch sustainability and income that should be explored. These may include:

1. Produce ranch products with a higher market value such as organic and natural meats. Demand for grass fed, organic, and natural meats is increasing. There are numerous infrastructural and marketing problems to grapple with here, and the profitability of this is not secure, but California range operations can produce this product, and an in-state population of 35 million is an attractive potential market.

2. Compensate ranchers for the open-space values they provide through conservation easements and mitigation. Because ranching is an extensive rather than intensive agricultural use, ranch lands protect many resource values. Provision of public goods like wildlife habitat, viewshed, and carbon-sequestration can provide some income to the ranch through these measures.

3. Encourage ranchers to manage for diverse goals. Because many ranchers are oriented to the amenity and lifestyle values of ranching, they may be receptive to managing for diverse goals. Diversification of ranching operations may increase their ability to generate profits in a market environment that is changing.

4. Encourage participation in state and federal programs such as the Williamson Act, Grasslands Reserve Program, Farmland Protection Program, and Conservation of Private Grazing Land Program. These programs seek to compensate ranchers for environmental stewardship and the production of open space and wildlife habitat in addition to beef.

5. Utilize grazing to reduce fire hazard. Housing developments sizably increase the demand for fire hazard reduction. Local planning that considers opportunities to use ranch lands as a fuel reduction buffer can address this demand. Coordination with public lands in the planning process would also help.

6. Identify mechanisms to improve the certainty of forage supply. Stable forage supply is key to stable ranches. Alternatives that address providing stable forage in light of irregular weather, reductions in public forage, and the conversion of foothill grazing lands to other uses will contribute to the persistence of ranches.

7. Ensure that the appropriate planning and infrastructure exists to support ranching operations. Coordinated planning with the agricultural community is a crucial factor in conservation of ranch lands. Ranches need extensive preferably interconnected rangelands, as well as buffering from vehicles and dogs, as do many wildlife species. In addition, there needs to be a sufficient business community to support infrastructure like large animal veterinary services, packing houses, and markets.

8. Questions for Further Study:

There are a number of questions important to the future of the Sierra foothills that this report could not address. Below are some of them:

1. How much private foothill land is linked to allotments in total?

2. What is the value of livestock production in the Central Sierra?

3. How has the price and availability of irrigated pasture changed since 1985?

4. How have real rental rates of private range changed over last 10 to 20 years in Central Sierra?

5. An “increase in public policy regulations” was reported as the most highly important factor in a decision to sell the ranch. Which regulations are the most difficult for ranchers to deal with?

6. What proportion of all Central Sierra ranchers have permits? And how do you define a ranch?

7. What proportion of the privately owned leased rangeland in the foothills is in the California Land Conservation Act or Williamson Act?

8. Do permittees have different concerns when considering a conservation easement than non-permittees?

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Appendix I: Methods for evaluating the value of an allotment to the ranch operation

Five methods were used to examine the economic relationships between permittee operations and their Forest Service allotment. First there is what permittees said themselves. This may be a subjective view, but one that perhaps sheds the most light on potential rancher responses to changes in access. Method number two examines the proportion of the herd that grazes the Forest Service allotment. Method number three compares the cost of alternative forage sources to the cost of using the Forest Service allotment. In the fourth approach, the costs of summer forage to permittees and non-permittees are compared to illustrate strategies used by some typical ranches that operate without grazing allotments. Finally, method number five uses detailed financial information to compare permittee and non-permittee ranch cash flows.

1. Method Number One: Rancher evaluation of allotment value to the ranch

The first method came directly from questions asked in the oral portion of the survey. Permittees were asked for their opinion of the importance of Forest Service forage to their operations in a series of questions. The results are simple averages of their answers.

2. Method Number Two: Proportion of AUM***'s from Forest Service Allotment***

The second method analyzed the proportion of the ranch's total "Animal Unit Months" (AUM's) that came from Forest Service allotments. An AUM is a standardized measure of forage, generally interpreted as the amount used by a mature or lactating cow in one month. The Forest Service considers an AU (animal unit) to be a mature 1,000 pound cow or the equivalent based on average daily forage consumption of 26 pounds dry matter per day.

A combination of information reported by ranchers and Forest Service records was used to determine the AUM's for each operation providing the information (n=17). The AUM totals for the allotments and the ranch total number of cows came mostly from the rancher's written survey where they were asked to give the number of AUM's or "head months" charged for in 1999, and to list the total number of cows on the ranch in 1999. Total ranch AUM's were calculated for the number of cows, bulls, yearlings, two year-olds, and calves as adjusted to a standard animal unit (Larson and Clawson 1988).

The AUM's from public range were calculated by multiplying head times months on the allotment or what the ranch reported in the written survey. There were many ranches where the Forest Service's data and the rancher's data did not match. Regardless, whenever possible, data supplied by the ranchers was used because this would allow analysis based on actual use during the year of the study. Each National Forest reported their grazing use differently and to different degrees of accuracy. Ranchers probably best know the details associated with actual use of the allotment because it is important to the management of their operation. Also, some ranchers had more than one lease, had more than one lease under their name that another family member could be using, or were subletting some of their lease, which made looking at Forest Service reports confusing and not representative of actual use. The proportion of use coming from Forest Service forage per ranch was calculated by dividing AUM's on Forest Service by the ranch's total AUM's. This was then averaged across all the ranches.

Most of the ranches interviewed use allotments that consist of Forest Service land intermingled with Sierra Pacific Industries property. Some National Forest records reflect the Sierra Pacific Industries' portion and some do not. The questionnaire did not address this in a way that would allow separation of the two but it was assumed that if the Forest Service lease were lost, the intermixed Sierra Pacific Industries lease would also be unusable.

3. Method Number Three: Prices of Alternative Forage Sources

In the third method the "replacement price" was calculated to estimate what the rental price might be to replace the AUM's on Forest Service allotment with al-

ternative sources of feed. The three alternatives highlighted are buying hay, leasing private range, and leasing private irrigated pasture.

For the first calculation, each ranch was assumed to replace forage within the county of the home ranch. This assumption may not be realistic because many ranchers travel outside their county and even outside their state for feed and, consequently, Nevada lease rates were looked at as well. The 1999 cost per ton of hay and per acre of irrigated pasture or range were taken from the appropriate California county crop report published in either 1999 or 2000 by the county Agricultural Commissioner. In some crop reports, the per ton price for hay was given for alfalfa and grain. Where possible, alfalfa was not used and less expensive feeds were chosen. Estimates of lease rates a rancher from the Central Sierra might find in Nevada were supplied by Willie Riggs, Nevada's Eureka County Extension Educator. AUM's on Forest Service allotments are from the analysis done for economic method number two. The total fees paid for 1999 are from the written survey, either from the question asking for "Total 1999 billed grazing use ($)" or from the Forest Service land lease line item in the financial portion. Many times, however, these two numbers did not agree and Forest Service records were used to clarify. Also, in some places where a rancher did not give price information, Forest Service records were used. As in method number two, this method does not include all the ranches in the study because they did not all provide adequate information (n=10 to 16 depending on particular analysis).

Through discussions with Shasta County University of California Cooperative Extension Livestock Farm Advisor, Larry Forero, the amount of the alternative forage source that would be needed to replace an AUM was estimated. The conversions used were that 0.4 tons of hay alfalfa hay, or 0.2 acres of irrigated pasture, or 2 acres of range is the equivalent of one AUM (Larson and Pratt 1988). Once the amount needed was determined, it was multiplied by the cost and averaged across all the ranches. Additionally, estimates from practitioners in the field were collected. The statistics used for the "expert" calculation are from Mike Connor of University of California Sierra Research and Extension Station in Yuba County.

4. Method Number Four: Comparison to Ranches without Allotments

Economic surveys of non-permittees with similar numbers of cattle were conducted, and their costs for summer forage are compared to those of permittees as case study examples. The cost section of the mail-back portion of the survey asked permittees to split out what they spent on their allotment and the non-permittees were asked to split out what they spent on summer forage (leased or owned). Non-permittees were less motivated than permittees to fill out the detailed financial part of the questionnaire, therefore comparisons are exemplary rather than representative (Table APP-1).

5. Method Number Five: Role of the allotment in ranch cash flow

Interviewees who filled out the financial section were divided into herd size categories. There are four permittee ranches in the 199 cows or fewer category, four permittee ranches in the 200 through 499 cows category, and two permittee ranches in the 500 cows and over

Table APP-1: Surveys completed and returned by Central Sierra ranchers with and without Forest Service grazing allotments, 2000-2001.

	Oral Interview Complete	Written Survey Returned	Financial Section Complete	Small Ranch (199 head or less)		Medium Ranch (200-499 head)		Large Ranch (500+ head)	
				Total	Filled out financial section	Total	Filled out financial section	Total	Filled out financial section
Permittees*	23	19	10	7	4	7	4	4	2
Eldorado	6	4	2	1	1	1	0	1	1
Stanislaus	9	9	6	2	2	5	3	2	1
Tahoe	7	5	2	4	1	1	1	0	0
Tahoe/ Eldorado	1	1	0	0	0	0	0	1	0
Non Permittees	14	5	2	5	2	4	0	4	0

*There are 5 Forest Service permittees and 1 non-permittee of unknown size. Of the original 25 permittees selected for interviews, one survey was not completed and one no longer used the Forest Service permit.

category. Only two written surveys of non- permittees were returned with the financial section filled out and both are the in the small category with 199 cows or fewer (Table APP-1). The ranches in each size category (small, medium, and large) were averaged together to model three "typical" ranches. These were then used to estimate how much each group was spending on their summer forage and what their costs might look like if they needed to replace the Forest Service summer lease with private leases or feeding hay. This was done with the same data from methods two and three above. Again, these are exemplary rather than representative cases.

The totals for the example ranches were computed slightly differently depending upon what the item was. For "Total Livestock Sold," the averages for each type of animal were calculated assuming that if the rancher left the line blank that meant that he or she did not have any of that type of animal. Therefore the blanks for this portion were counted as zeros and the averages were taken accordingly. For all other portions of the financial analysis a blank was not taken into consideration for the averaging process.