

RESEARCH

Land use change in three San Francisco Bay Area counties: Implications for ranching at the urban fringe

Larry Forero, Lynn Huntsinger, and W. James Clawson

ABSTRACT: *California's rapid demographic changes are affecting the use and management of private grazing lands. Although it has been argued that expanding urban development is leading to rangeland overgrazing as animals are crowded onto the remaining range, an examination of 30 years of land use and livestock inventory data in the three San Francisco East Bay counties of Alameda, Santa Clara, and Contra Costa, shows that the decline in rangeland is paralleled by a decline in animal demand for forage. Shifts in livestock and crop production are evident. Sheep numbers have been drastically reduced due to dog, predator, and marketing problems. Traditional field and orchard crop production is in decline, while intensive greenhouse and nursery production is increasing. Although urban expansion causes problems for livestock producers, grazing is strongly supported by residents concerned about fire hazards. Management practices for "urban rangelands" are needed if range livestock production is to survive in much of California.*

CALIFORNIA is undergoing rapid demographic change. Population growth, technological advances, and shifts in the character and values of the state's population are affecting land use and management. The state's 12 million privately-owned ha (29.6 million ac) of non-forested lands or rangelands, including some 7.5 million ha (18.5 million ac) used for livestock grazing (16), are subject to increased demand for residential property, changes in the composition of rural neighborhoods, and modifications in public policy (16, 22). The most productive grazing lands are privately owned. Resource condition is strongly influenced by the needs and goals of the individual owner. Conversion to urban and residential

use removes substantial area from the resource base each year (16). These lands provide not only a livelihood to landowners, but a variety of public goods, including wildlife habitat, watershed, and open space. The direct economic value of range livestock grazing to California is estimated at more than \$300 million (16). Some experts argue that increased competition for land is leading to the crowding of livestock on remaining rangelands, causing resource degradation (38, 12). Three rapidly growing San Francisco Bay Area counties—Alameda, Contra Costa, and Santa Clara—provide opportunity for an in-depth look at the question of whether urban development is leading to overstocking on East Bay rangelands.

Contra Costa and Santa Clara counties are suburban outgrowths of the San Francisco and Oakland urban centers that in recent decades have begun substantial in-county industrial growth. San Jose and Oakland, two of the largest cities in California, are in Alameda and Santa Clara counties, respectively. The three counties are among the fastest-growing in net population in the state. California land use

controversies, particularly those concerning crop and grazing lands, are common in the Bay Area (4, 27, 17, 13, 32), and East Bay rangelands illustrate the types of issues likely to arise as California's rapid urbanization continues.

Study area

The study area, the contiguous Contra Costa, Alameda, and Santa Clara counties, borders the east side of the San Francisco Bay and the western-most fringe of the fertile San Joaquin Valley. Among the most densely populated counties in California, they include some of the state's most productive upland range, predominantly rolling oak woodlands with an annual grass understory (31). The mild Mediterranean-type climate is moderated by the maritime influence of the Pacific Ocean. An average annual precipitation of 441 mm (17.4 in) near the bay (Hayward) and 368 mm (14.5 in) in the eastern valleys (Livermore) results in excellent conditions for forage growth and livestock production. Wildlife is also abundant. The oak woodlands typical of the counties' open space provide breeding habitat for more than 300 vertebrate species (5). The predominant use for more than a 150 years of the open, non-forested grasslands and woodlands in these counties has been livestock grazing.

The three counties total 716,309 ha (1.77 million ac) and are inhabited by more than 3.5 million people. Elevation ranges from near sea level to the 1,333 m (4,372 ft) peak of Mt. Hamilton in Santa Clara county. More than 95 percent of the wildland in the three counties is non-forested or rangeland. Although Santa Clara county is roughly twice the size of Alameda and Contra Costa counties, and has significantly more land suitable for grazing (Table 1), according to California County Agricultural Commissioner's Reports (7) each county has a similar acreage of private land that is actually grazed, around 80,000 ha (197,600 acres) (Figure 1). In each county, between 10 and 20 percent of all rangelands are in pub-

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lic ownership, predominantly with state and regional parks and preserves.

Methods

A variety of sources were used to gather information about land use change in the three counties. Primary among them were the annual reports of County Agricultural Commissioners (CAC). These report the countywide area of agricultural land used to produce various crops, including forage for grazing. Information is usually obtained from questionnaires sent to producers. Methods and accuracy vary from county to county (7).

Another source of information was the Farmland Conversion report produced by the California Department of Conservation as part of the Important Farmland Mapping Program (IFMP). These reports are produced biennially and provide information about changes in the extent of farmland, including range and pasture lands. Information is obtained through aerial photography, and a Geographical Information System (GIS) is used to track extent and use changes (9).

The 1983 County Resources Inventory (CRI), produced by SCS, includes the area of private grazed, wildlife, and

crop lands. Information was obtained from a variety of existing maps and ground surveys (35).

The extent of cover types and landownerships provided by the Forest and Rangeland Resources Assessment Program (FRRAP) of the California Department of Forestry and Fire Protection was developed from aerial photography (10, 6). The U.S. Census Bureau collects information for the Census of Agriculture by sending questionnaires to all farm operators (36, 37). In 1959, farms were basically defined as marketing more than \$50 worth of agricultural products; in 1987 to qualify as a farm, \$1,000 worth of products had to be marketed yearly.

Also used was the California Crop and Livestock Reporting Service (1960-1990), reporting county inventories of sheep and cattle (8).

Terms and definitions

The problems encountered in using these different sources of information are illustrated by comparing private rangeland as reported by each source (Figure 1). Part of the problem lies in distinguishing rangeland from "grazing land." According to the definitions of the Society for Range Management

(SRM), these are not the same. Rangeland is any land managed primarily with respect to an herbaceous component, as compared to forest lands that are managed primarily with respect to trees (25). Grazing is only one possible use of rangeland. Grazing use is difficult to determine from aerial photography, a common means of mapping land use. Differing methods of acquiring information and defining terms result in different amounts of land being reported as rangeland or grazed land by each agency. The results of differences in methods of data acquisition and reporting are fairly consistent from county to county (Figure 1), with the Agricultural Commissioner's report usually being the most conservative.

FRRAP defines rangeland most broadly and is perhaps closest to the SRM definition. Because information was generated from aerial photos, land types are defined by characteristics discernible on aerial photos, rather than management practices or particular uses. Rangeland, by the FRRAP definition, is all wildlands that are not forest-cover types. This includes desert lands and oak woodlands. Land meeting this description is included regardless of topographical characteristics, use, or management (16).

The rangeland delineated by IFMP is more restrictive. It includes "land on which the existing vegetation, whether grown naturally or through management, is suitable for grazing or browsing of livestock. Not included are heavily brushed, timbered, excessively steep, or rocky lands that restrict the access and movement of livestock." A Grazing Land Advisory Committee in each county helped to identify "suitable grazing lands" (9). The Census of Agriculture (36, 37) asks for the amount of land used only for pasture and range, including woodland, regardless of its topographic or vegetation characteristics.

CRI inventoried grazed land, including only lands actually grazed during the year of inventory and used primarily for forage production (35). County Agricultural Commissioners provide the land area reported to them by producers as currently used for livestock production, calling it range or dryland pasture (7). Comparing the Agricultural Commissioners' "grazed range" to FRRAP's "private rangeland," is one way to estimate the percentage of private rangeland grazed in each county: 77 percent in Alameda, 71 percent in

Table 1. Land use in Alameda, Contra Costa, and Santa Clara Counties, 1988 in hectares¹.

County	Urban	Crops	Grazing land	Other land	Water	Total
Alameda	53,360	4,480	103,049	29,693	21,386	212,329
Contra Costa	52,081	27,065	91,695	16,193	21,253	208,286
Santa Clara	70,369	20,181	164,759	79,672	3,255	338,236

¹ Adapted from (9). Urban=one structure per .61 ha; Crop=crops produced in last three years; Grazing=lands suitable for grazing.

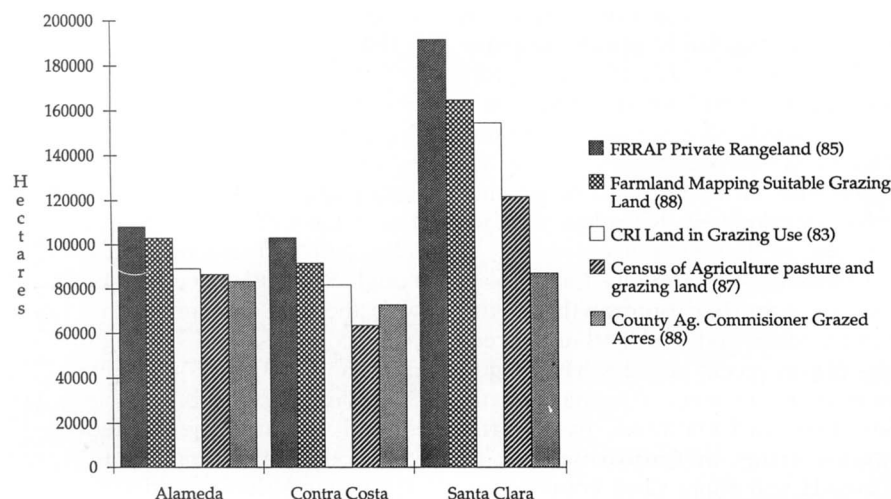


Figure 1. Comparison of private rangeland and grazing lands for each county.

Contra Costa, and 45 percent in Santa Clara. In Alameda and Contra Costa counties, where much of the rangeland is oak savanna, the proportion of rangeland grazed by livestock coincides with the 77 percent estimated for the state's oak woodlands in a 1985 survey of oak woodland landowners (23), and is close to the 70 percent estimated by using FRRAP's statewide figures for range and grazing lands. In Santa Clara County, using grazed rangeland estimates reported by the CRI, Census of Agriculture, or IFMP would yield similar results while the County Agricultural Commissioner's estimates of grazed lands are far lower (Figure 1).

Results

The human population of Alameda, Contra Costa, and Santa Clara counties has increased by 74 percent from 1.9 million, to 3.5 million in 1990. The population is anticipated to increase to 3.9 million by the year 2005 (3). Hectares of field crops have decreased by 52 percent over the last 30 years (7). Vegetable, field, and orchard crops have declined by more than two-thirds (Figure 2). The majority of these areas have been converted from agricultural to urban uses, including roads and freeways, with less than 10 percent going into crop production (9, 16). Shopping centers and homes occupy areas where vast orchards once existed. On the other hand, hectares of nursery crops, although small in comparison with other crops, have increased by 47 percent (Figure 2).

Grazed dryland hectares have remained relatively stable, decreasing only 13 percent overall since 1960 (Figure 3). In absolute terms, about twice as much cropland, 67,000 ha (165,490 ac), was lost as rangeland, 38,000 ha (93,860 ac) (Figure 4). The decline in area of grazing land is very similar to the decline in livestock numbers, summarized as animal demand. The overall 14 percent decline in animal demand reflects a 94 percent decline in sheep and a slight increase in cow and yearling numbers.

Discussion and conclusions

There is no evidence to support the argument that grazing lands are becoming more crowded due to the shrinking resource base in these three counties. In fact, it appears that range animal demand and land available for grazing have declined in tandem, reflecting the

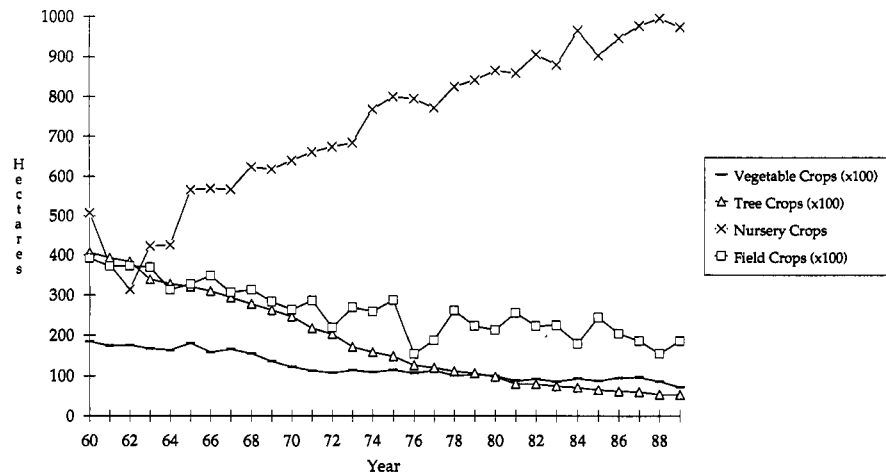


Figure 2. Crop hectares in Santa Clara, Alameda, and Contra Costa counties. 1963-1990 (7).

economic logic of providing adequate forage for stock and protecting the long term productivity of the resource (Figure 3). On the other hand, there have been significant changes in range livestock and crop production.

Over the last 30 years land use conversion has affected cropland more than rangeland and grazing lands (Figure 4). Compared to level or gently sloped croplands, grazing lands tend to be on steeper terrain, of limited accessibility, and on unstable soils, any of which may limit potential residential development (30). A bar-chart of total changes in land use in the three counties resembles a toothpaste tube being squeezed from the bottom—the cropland is being pushed right out the top. This phenomenon has been described also as a “perimetropolitan bow wave,” or standing wave, with changes in agricultural production occurring in expanding rings around a growing urban area (21).

Part of the wave phenomenon is change in and intensification of agriculture on croplands at the urban fringe (21), as documented by increases in nursery crops and decreases in field and orchard crops in the East Bay counties. Typical is a shift to more intensive agriculture on smaller parcels (e.g., greenhouse production) in response to higher land costs and the growing market for ornamental plants and flowers that accompanies urbanization.

But in these Bay Area counties the most widespread form of agricultural production is livestock grazing. The wave of change affects rangelands as a

corona of effects spreads out from urban development and new subdivisions (22). In the Bay Area, urban out-migration is still a major trend, with families going farther and farther away from the Bay in search of affordable housing. Rangeland ownership is broken up into subdivisions, with oak woodlands, and highly productive rangelands in the three counties often preferred for housing construction (20, 15, 31).

Ranching in an urban environment brings with it a whole new set of problems, including trespassing, poaching, property damage (due to vandalism and off-road vehicles), and theft of both property and livestock. Urban-oriented residents often think that open land is to some degree synonymous with public land and, unthinkingly trespass (20, 12). On the other hand, stray cattle can cause problems for residents whose property is not fenced (14, 20).

Changing attitudes toward wildlife also affect livestock production. Predator control is highly restricted. Both mountain lions (*Felis concolor*) and coyotes (*Canis latrans*) are common in the study area and occasionally harm livestock. In contrast, public interest in recreation and wildlife may eventually offer some economic opportunities to ranchers who can accommodate a fee-based use of their land (34).

A serious problem for ranchers is increasing use of rural highways. Winding canyon roads can become major routes for commuters dodging freeway jams and a stray cow can cause serious traffic accidents on these roads (14). Even intentional use of a county road,

for driving cattle a half-mile to new pastures, requires the traffic control efforts of the California Highway Patrol. Trucking cattle for the short distances they were once herded is another consequence of increased traffic. A shortage of personnel able to recognize the unique problems that accompany range-livestock operations is an issue for law enforcement agencies. Local sheriffs' departments have attempted to correct this by forming rural crime units responsible for handling problems in the agricultural community.

Dogs owned by new residents have caused shifts in livestock production practices, contributing to the virtual extinction of sheep production in these counties. Numbering more than 40,000 in 1960, today there are fewer than 3,000 sheep in the three counties. Remaining sheep bands are kept close to home in small corrals. A rancher who has long grazed yearling, or stocker, cattle may change to grazing cows with calves, as most of the year cows are better able to stand up to marauding dogs. On the other hand, speculative ownership of rangelands at the urban fringe may shift emphasis from cow-calf operations to stocker cattle, and from owner-operator production to leasing land out for grazing. The expectation of selling land for development makes the long-term investment required to maintain a cow-calf operation less attractive than the short-term investment required for stocker production, where animals are purchased and sold within a single year and land is often leased (20). These changes in

production practices can have significant impacts on the rangeland environment, due to changes in the intensity, duration, and timing of grazing and in the kind and class of grazing animal.

Although there are no comprehensive statistics available on horse numbers in the study area, the number on farms has doubled and in the case of Contra Costa county, tripled from 1959 to 1987 (36, 37). A far greater increase might be expected on non-farms such as large-lot residential areas or ranchettes. The overstocking of small pastures with horses is commonplace, but their influence on the rangelands remaining in extensive tracts is probably not great. Localized influence on urban riparian corridors and slopes can be severe.

Research has shown that the California Land Conservation Act, initiated in 1968 to prevent rapid urban expansion into agricultural areas by basing property tax assessments on use value, is least effective in areas where it is needed most (29, 11, 18, 19), unless coupled with firm countywide zoning and planning (29, 12). In Alameda County, a large portion of the agricultural land is currently under protective contract, but the owners of many parcels adjacent to existing urban areas have recently filed for non-renewal (2). Unfortunately, local zoning ordinances are viewed as fairly flexible by developers, so the prices of supposedly restricted properties remain artificially high. A 53 ha (131 ac) ranch in Alameda County that sold for \$3,500 in 1902 closed escrow in November 1990 for \$2.3 mil-

lion. The average value of a farm in the three counties has increased seven-fold between 1959 and 1987, despite that a greater proportion of the land included in the 1987 statistic is lower value rangeland (36, 37). Such prices make it practically impossible for someone to enter into the livestock business in the study area. Yet livestock producers generally are ambivalent about planning efforts aimed toward preserving agriculture, because it may mean foregoing highly lucrative urban development opportunities (26, 12).

Ranching—an urban future

In the highly urbanized Bay Area, ranching as a way of life seems an anachronism. But despite difficulties, livestock grazing is likely to continue to be an important land use in the Bay Area for at least another 10-20 years. Preferential development of croplands will continue until cropland preservation ordinances prevent further losses. Although the area of range and grazing land is declining, restrictive zoning ordinances, acquisition of land by the government and the public for parks, open space, and private reserves assure some land will remain undeveloped. On most of these lands, residents on the urban/rangeland interface recognize the need for continued grazing to reduce fire hazard.

Fire hazard is a critical issue in California's suburban areas, especially where open lands border expensive homes. The recent Oakland-Berkeley Hills firestorm destroyed more than 3,000 residences and caused an estimated \$1.6 billion worth of damage in Alameda County. Recent efforts by the California Department of Parks and Recreation to remove grazing from Contra Costa's Mt. Diablo State Park have come up against powerful local opposition based on fire hazard to surrounding homes (24). Many Bay area ranchers use some public land in their operation—more than 80,000 ha (177,600 ac) of publicly-owned park land in the study area are grazed. Livestock grazing is acknowledged by local fire chiefs to be the least expensive method of controlling fire hazard on the grasslands that cover much of these parks (28). Controlled burning, the other method most often used, is becoming increasingly difficult due to the hazard posed to surrounding residences and air quality restrictions. Some public agencies have even resorted to paying a goatherd to graze

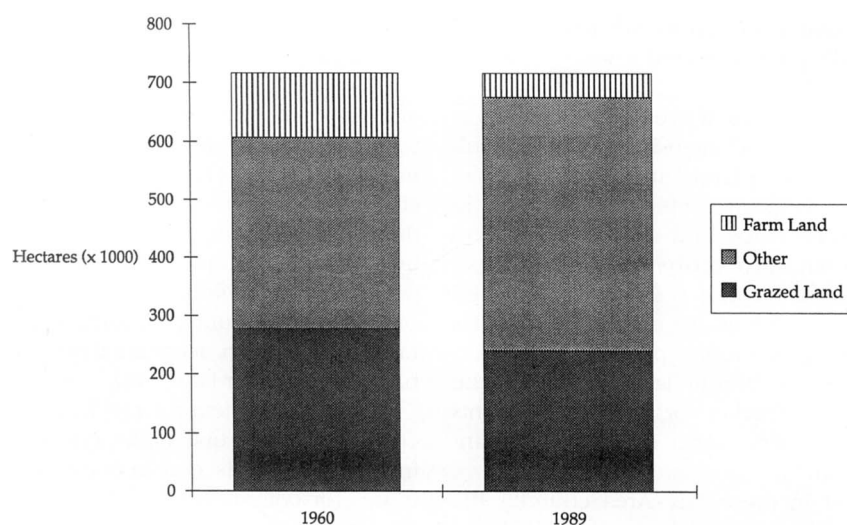


Figure 3. Grazed hectares and animal demand, Alameda, Santa Clara, and Contra Costa counties.

brushy areas to reduce fire hazard.

Livestock grazing and ranching also have a role to play in the maintenance of open space in the Bay Area. Budgetary constraints are limiting land acquisition efforts by public agencies, and emphasis is shifting toward restrictive zoning ordinances and private contracts and trusts as methods for preserving open space. Grazing often continues on these lands as part of contract agreements or for reduction of fire hazard (30). When part of a comprehensive planning strategy, support for a vigorous ranching industry can be one way to maintain open space, wildlife habitat, and a rural setting though not a substitute for parks and preserves (20).

New approaches to livestock management are needed for the urban-range fringe areas of the state. The challenge is to manage stock and lands to reduce conflict with urban neighbors. For example, judicious public land use for grazing can help stabilize the ranching community, and at the same time, reduce fire hazard. But grazing must be managed to protect and even enhance wildlife habitat, watershed conditions, and recreation opportunities if it is to be part of the long-term picture for public lands, particularly since there is no multiple-use mandate for the state and regional park lands that predominate in the Bay Area.

One scenario for urbanizing rangeland or wildland areas suggests that as ranchers at the urban fringe focus on selling out in the near future, they lose incentive to invest in the long-term productivity of the land (22, 6, 20), resulting in resource degradation. This might also occur due to absentee ownership of rangelands as livestock grazing continues on a lease basis while distant speculators own the land (12). A model of the cyclical path of rangeland loss could be described as follows: worsening rangeland conditions on neglected lands lead to reduced public support for ranching, encouraging further suburban and urban development, which puts more rangeland into speculative ownership. In the study area, the percentage of farms operated by tenants has nearly doubled between 1959 and 1987, increasing from 10 percent to 17 percent (36, 37). The proportion run by operators who live off the farm has also doubled, from 15 percent to 29 percent (36, 37).

This paper does not purport to an-

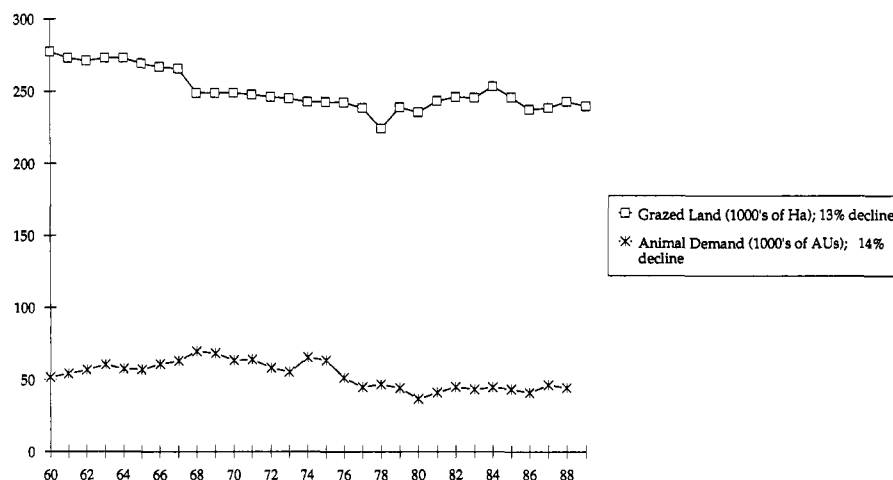


Figure 4. Land use change in Alameda, Contra Costa, and Santa Clara counties from 1960-1989.

swer all questions about localized overgrazing or overuse and the influence of an expanding urban fringe on practices and ultimately on the productivity of the surrounding resource base. Certainly urban growth leads to changes in management and production practices. It is likely that horse numbers have increased drastically in the study area, but virtually no information about this land use is available. Research is needed into the proximity effects of urban areas on ranching, the production of diversified goods from rangeland, the magnitude and effects of increases in horse numbers, and the development of effective incentives for sustainable rangeland use.

Rangeland enhances the value of natural preserves, parks and public lands by buffering them from the urban fringe, expanding the area available to wildlife, and connecting isolated areas to each other—magnifying a refuge's effective size many times (33). Even if sufficient incentives are found to encourage the state's existing ranchers to continue their extensive management of land and resources, important questions remain. Current commodity values and the cost of production make entering the livestock business difficult for those interested in livestock production. As today's ranchers age and retire, who will replace them, and how will the land be managed? It will take strategic, definitive decisions by planning groups and the public, as well as special efforts by the livestock industry, if rangeland grazing and the public goods it provides in urban areas is to remain a part of the landscape.

(This cannot be considered equivalent to absentee ownership, however, as it only includes operators. Huntsinger and Fortmann (23) found that about 23 percent of California oak woodlands are in absentee ownership).

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