



Research

Sustain livestock ranching to sustain habitat: land sharing at risk on San Francisco Bay Area exacted conservation easements

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ABSTRACT. Grazing lands supporting livestock production and nature conservation exemplify land sharing conservation. In California, livestock producers own or manage a large portion of land with the highest biodiversity ecosystems. Grazing reduces flammable biomass and can benefit habitat of numerous rare and endangered species. However, the role of grazing, livestock production, and rancher stewardship in conservation is often overlooked. Spatial analysis shows a significant contribution of grazing lands to conservation in the San Francisco Bay Area (SFBA) that is not recognized in regional planning analyses. Lands protected for conservation cover nearly 0.5 million ha, or 29% of the SFBA, and 43% of the protected land is grazing land. Over 65% of the region's land described as essential or important to conservation by the regional planning network is grazing land. A case study review is used to examine in greater depth the management dynamics of partial-title acquisition of grazing land for conservation. Exacted conservation easements, a type of easement fulfilling mitigation requirements for land development, are growing in use in the SFBA and throughout California, and they are well funded by development interests to support conservation. Political ecology theory terms a redefinition of territory that can displace resource users and enable others to benefit from newly created economic values, reterritorialization and capital accumulation. A case study of exacted easements on SFBA ranches reveals how the resulting redefining of the land's purpose and the significance of its various ecosystem services provides funding for third parties for new services required to implement and uphold the easements, but not necessarily to support land sharing and the ranching livelihood that provides grazing needed for habitat management. Planning that considers the needs of the livestock operation would increase the probability of achieving desired conservation outcomes and the durability of appropriate habitat conditions.

Key Words: *capital accumulation; conservation easements; endangered species; grazing; land sharing; land trust; livestock production; protected areas; rangeland; reterritorialization; San Francisco Bay Area*

INTRODUCTION

Nature conservation strategies have primarily relied on acquisition or at least partial acquisition to protect land (Adams et al. 2014). Acquisition by the state or a conservation organization often results in a land sparing conservation strategy that excludes development and human use of the land, segregating agricultural production from conservation (Middleton 2013, Phalan et al. 2014). However, grazing lands supporting livestock production, which account for over half of the earth's agricultural land (White et al. 2000, Lambin et al. 2001, Reid et al. 2014) are at greatest risk for habitat loss from land use change. Most grazing lands, 91%, can be described as rangelands (Reid et al. 2008); rangelands are those on which the vegetation is predominantly grasses, grass-like plants, forbs, or shrubs managed as part of a natural ecosystem (Spiegel et al. 2016). Among rangeland ecosystems globally, over 40% of temperate grasslands, savannas, and shrublands, and Mediterranean forests, woodlands, and scrub have been converted to other anthropogenic uses (Hoekstra et al. 2005), and grassland birds, as an example of the outcome of conversion and global woody encroachment (Archer et al. 2017), are rapidly declining in North America (Sauer et al. 2015). Suburban and exurban development, transportation and renewable power infrastructure, and where feasible, more intensive agriculture all have much greater economic value than livestock production, and changing rangeland to these uses diminishes or extinguishes many of the land's resource values and ecosystem services (Brunson 2014, Cameron et al. 2014).

Lands supporting livestock production and nature conservation can exemplify land sharing conservation (Huntsinger and Sayre 2007, Barry and Huntsinger 2021). Grazed rangelands can provide forage for livestock and produce food and fiber while supporting watershed functions, storing carbon, and providing

open space, habitat, and other ecosystem services (Booker et al. 2013, Sayre et al. 2013, Yahdjian et al. 2015). Livestock production and other traditional management practices have created and maintained rangeland ecosystems while supporting livelihoods and rural communities (Middleton 2013, Huntsinger and Oviedo 2014). In addition, grazing itself can support biological diversity by managing vegetation and maintaining habitat structure and ecosystem functions (Rook et al. 2004, Vogel et al. 2007, Yaun et al. 2016, Barry and Huntsinger 2021).

In California, livestock grazing reduces flammable non-native biomass and has been shown to be beneficial for the habitat of numerous California rare and endangered species (Barry and Huntsinger 2021, Ratcliff et al. 2022). Although grazing values and services are increasingly documented (Huntsinger and Oviedo 2014), the factors needed to maintain grazing and grazing management are often overlooked when land is acquired for protection, even when the utility of grazing for species conservation is recognized (Middleton 2013, Farley et al. 2017). Varied kinds of conservation easements on ranches, based on acquisition of partial title, are a growing portion of the state's protected lands, as is the national trend (LTA 2020). Here, we use spatial analysis to examine the contribution of grazing lands to protected areas in California's San Francisco Bay Area (SFBA) and delve into a case study to understand the social dynamics of the relationship between ranchers and conservation partners as they affect management capacity for meeting environmental goals.

Fortress conservation, land protection via acquisition

Globally, the creation of protected areas has often resulted in the displacement of natural resource-based activities and livelihoods (Adams 2004). As a conservation approach, removing people and

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their livelihoods from land has been described by Brockington (2002) as fortress conservation. Such an approach is predicated on the assumption that human activity, at least related to natural resource use, is antithetical to conservation and that removing these activities and protecting the land from people restores nature (Peluso 1993, Brockington 2002, Neumann 2004, Kabra 2018). Fortress conservation has been applied to landscapes across the globe, but research indicates that setting aside an ecosystem to let nature run its course does not necessarily support the conservation values society expects (Verdú 2000, Middleton 2013, Biró et al. 2020, Michaels et al. 2022).

Although acquisition may prevent human degradation associated with some types of land-use change, state or conservation ownership alone can neither ensure land management nor protect various ecosystem services. In describing the limits of acquisition as a conservation strategy, Fairfax et al. (2005:257) identified a fundamental problem: “ownership does not ensure control.” At times public funds are insufficient, or controversy over management too severe, to carry out needed management or even maintain public properties. Many places protected for endangered species require active management (Scott et al. 2010), more characteristic of land users, to maintain habitat suitability. For example, typical rancher activities that support the production of livestock such as controlling invasive plants and animals, managing livestock grazing to maintain grasslands or minimize thatch, or setting prescribed burns are also recognized as necessary activities to maintain biodiversity (Weiss 1999, Marty 2005, Maret et al. 2006, Germano et al. 2012, Marty 2015, Adamidis et al. 2019). Across continents, biodiversity related to species richness, landscape heterogeneity, and function may decline on protected lands when traditional management is not maintained (Middleton 2013), and California, with over 250 years of livestock grazing history, is no exception (Huntsinger and Oviedo 2014).

Conservation easements, land sharing conservation

A conservation strategy that can facilitate land sharing is partial-title acquisition with a conservation easement. Through donation or purchase, a conservation entity acquires the development rights, preventing land use change, but often continuing to allow uses such as livestock grazing as long it is compatible with the easement’s conservation objectives. Restrictions are recorded in the deed restrictions that run with the land title, typically for perpetuity (Lippmann 2004). In California, where land use change from exurban sprawl and conversion to intensive agriculture has been intense, there has been substantial growth in the use of conservation easements to protect land. Over 830,000 ha or about 2% of the land in the state has been protected, with 11,250 different conservation easements held by 225 different non-profits or government agencies (Cameron et al. 2014, GreenInfo Network 2018).

On rangelands, conservation easements are not only considered a tool to protect ecosystems, but many rangeland owners also consider them critical to sustaining their ranching operation in the face of development pressure and poor economic returns from livestock production (Huntsinger and Bartolome 2014, Huntsinger and Oviedo 2014). Rangeland owners and conservation interests in California note that grazing management and stewardship has protected much open space and biological diversity (Barry et al. 2007). Owley (2011), who studied

the enforceability of easements, attributed a land protection ethos to landowners that donate or sell an easement to maintain a working landscape such as a ranch, timber forest, or farm; a conservation ethos was also documented in survey research (Huntsinger et al. 2010). The demand for easements among California ranch owners is so strong that the California Rangeland Trust has 177,250 ha of privately owned rangeland awaiting funding for permanent conservation through easements (CRT 2021). This demand, coupled with an unprecedented need for mitigation sites by public agencies and businesses to meet local, state, and federal permit requirements for development projects, has resulted in the growing use of exacted or mitigation easements throughout California (Rissmann et al. 2007, ICF 2010, 2012).

Like donated and other purchased easements, exacted easements provide land protection but focus on mitigating environmental impacts, usually habitat loss, from a development project (Lippmann 2005). Because California has thousands of unique and endemic plant and animal species, hundreds of which are state and federally listed as threatened or endangered, it is nearly impossible to undertake a project on undeveloped land without being required to mitigate environmental impacts. Projects benefiting from exacted easements include exurban projects like subdivisions, schools, parks, shopping centers, and public works projects such as reservoir expansion, road improvements, high-speed rail, and green energy projects. Exacted easements, paid for by the developer, are well-funded. In addition to purchasing land use rights, the developer funds a non-wasting endowment to overwrite conservation activities required by the state on the easement in perpetuity. Although the developer is required to purchase an easement and fund it, a landowner volunteers to accept the conservation easement (Owley 2011). Nevertheless, the conservation easement defines what is valued for conservation, and funding the non-wasting endowment makes explicit what activities are valued for conservation and who can perform these activities. Cost analysis of managing nature is limited (CNLM 2004) and there is limited mention in the literature of funding for easement activities.

Study objectives

In this study, first we assess the role of grazing land in land conservation in the SFBA using spatial analysis. Second, through a ranch case study, we develop an ordered situational map to understand the social dynamics of a partial acquisition conservation strategy, exacted easements. We consider which conservation activities and providers are valued and which may be deprived by this conservation strategy and draw from the field of political ecology to explore the broader implications of our case.

METHODS

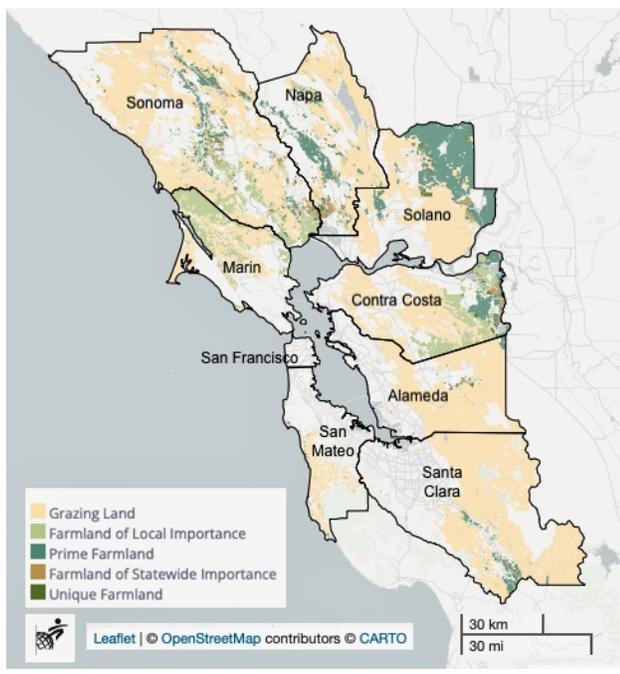
Study area

The SFBA encompasses nine counties (Fig. 1), totaling approximately 2 million ha. For this project, the city and county of San Francisco, which is predominantly urban, was excluded. The SFBA is within the California Floristic Province, one of the world’s top biodiversity hot spots with over 100 federal- or state-listed threatened or endangered species and several unique ecosystems (Meyers 1990, Bartolome et al. 2014). Although rapid land-use change driven by a growing population has led to habitat loss, public support for land protection is very high, providing

Table 1. Data layers, definitions, and data sources used to describe land use, land protection, and conservation.

Data layers	Definitions	Data sources
Protected lands	Lands protected from development through public acquisition: fee-simple title or partial acquisition. Fee-simple title lands may be grazed or ungrazed parks, nature reserves, or open space; a few are farmed. Partial acquisition, or lands with conservation easements may be grazed or farmed. Easements may be donated or purchased, mostly on private property: some overlay public land.	California Protected Areas Database; California Conservation Easement Database (GreenInfo Network 2018)
Agricultural land use	Prime farmland, farmland of statewide importance, and unique farmland were aggregated as farmland. These designations all require land to have been cultivated for agricultural use within the past four years (4 ha minimum) Farmland of local importance is defined by a county; it may include grazing land, unirrigated croplands, small orchards, and vineyards (4 ha minimum) Grazing land is almost exclusively rangeland; land must have vegetation suitable for livestock grazing and be a minimum of 40 acres (16.2 ha) “Other” includes all undeveloped land that is not farmland nor grazing land; it includes forested land as well as state parks and other government properties that restrict agricultural use.	California Farmland Mapping and Monitoring Program (California Department of Conservation 2018)
Habitat suitability	Suitable habitat provided for protected plant or animal species. Designation is based on the Habitat Relationship Model for 34 terrestrial animal species and California listed land cover types for 67 plant species within 2 miles (3.2 km) of verified occurrences as reported in the California Natural Diversity Database (CNDD).	Mitigation Wizard (Bay Area Green Print 2021)
Priority conservation lands from Conservation Lands Network 2.0	Marxan, conservation planning software (Ball et al. 2009) identifies land that meets specific conservation targets for minimum cost. Targets were developed from habitat data and species occurrences (CNDD). Cost is considered the inverse of suitability, defined via scores from distance to roads, population density, and parcelization. Categories from Marxan included “Areas essential to conservation” (16 or more times out of 20 Marxan model runs), “Areas important to conservation” (11 to 15 times out of 20 runs). Additional categories not selected by Marxan included “Connecting lands that ensure network connectivity,” and “Contributing lands.”	CLN 2.0 (Bay Area Open Space Council 2019)

Fig. 1. Study area: agricultural lands in the nine-county San Francisco Bay Area, California.



funding for open space and supporting numerous land trusts and acquisition campaigns (Thorne et al. 2013). Parks, wildlife agencies, water districts, and land trusts have created a system of protected lands that includes parkland, preserves, watersheds, farms, and livestock ranches. Protected lands include public lands (fee-simple title) and lands with conservation easements (partial-title acquisition). In addition, land development is controlled through general plans and zone restrictions, urban growth boundaries, and tax breaks for agricultural land, though these have proved vulnerable to development pressure (Rissman and Merenlender 2008). Case study researchers have pointed out that using a case that is solely representative, such as an average or typical case, is often not the richest in information. Cases should generally be chosen that have a high expected information gain, and that a site may be chosen because of researchers’ in-depth local knowledge, enabling them to develop reasoned lines of explanation based on a rich knowledge of setting and circumstances (Fenno 1986, Seawright and Gerring 2008). The SFBA is such a case for the authors.

Spatial data analysis

To assess the role of grazing lands in supporting conservation, including providing habitat for threatened and endangered species, spatial analysis was conducted across four different data layers: protected lands, agricultural use, habitat suitability, and conservation network priority lands (Table 1). These data layers and others are available from the Conservation Lands Network 2.0 (CLN 2.0), a regional planning effort focused on protecting

Table 2. Case study participatory observation activity for exacted conservation easements on three ranches in Alameda County, California.

Easement ID (Ranch-easement number)	Easement ha	Year created	Participatory observation activity
MN-1	12.3	2002	2007 to 2020, conducted annual monitoring with landowner for easement holder
MN-2	43.3	2005	2007 to 2020, conducted annual monitoring with landowner for easement holder
CR-1	39.6	2009	2011 to 2020, participated in resource management for easement holder including weed abatement, fence and water system repair, debris removal, and road maintenance
KL-1	48.6	2011	2010, reviewed draft management plan with easement holder and recommended changes
MN-3	34.5	2015	2014, worked with easement holder to develop baseline resource information, conducted annual monitoring with landowner from 2015 to 2020
CR-2	146.8	2019	2018, reviewed draft management plan with easement holder, consultants, and landowner and recommended changes

one million ha, or 50% of the region by 2050 (Bay Area Open Space Council 2019).

From the data layers in Table 1, the proportion of land acquired by fee-simple title and conservation easement in each agricultural land use category was calculated. To determine what land use types are providing habitat for threatened and endangered species, the percentage of potential suitable habitat by land use for each protected species was generated. The land use that provided 50% or more of the habitat for each plant and animal species on protected versus unprotected land was counted. To identify what land uses are associated with priority lands for conservation, the proportion of unprotected land in the four conservation priority categories by each land use type was calculated.

Case study: exacted conservation easements and the Golden Hills Ecological Preserve

To understand the impact of exacted conservation easements on nature and social relations, we engaged in participatory observation and reviewed documents for five exacted easements on three cattle ranches in Alameda County, California (Table 2). The properties have similar habitat and land use history and were selected because the land trust and landowner invited us to participate in easement development or monitoring, which provided access to data. Exacted easements in the case study were placed on the ranches from 2002 to 2019 and ranged in size from 12.3 ha to 146.8 ha. Four of the easements are held by the same easement holder, a rancher-oriented land trust. One easement is currently held by a public agency requiring mitigation credit (CR-1). Participatory observation occurred between 2007 and 2020 and has varied by easement, landowner, and age of easement, as detailed in Table 2. The consideration of five easements initiated over 16 years shows some evolution in easement agreements and funding for management over time; the most recent easement, CR2 (listed in Table 2), is fully described and highlighted in this study.

Documents reviewed for each easement included management plans, monitoring reports, and budgets used to calculate annual funding required for stewardship and management. During our fieldwork from 2019 to 2020, semi-structured interviews were conducted in person and by phone with 12 individuals, including three from wildlife regulatory agencies, three consultants, three rancher landowners, and three from entities that hold easements. Interviews established that findings were not exclusive to our main

case study, but similar for other easements in the region. Interview questions focused on the following:

1. conservation values protected by mitigation easements,
2. the impact of easements on ranching and conservation practices, and
3. conservation easement monitoring, management, and funding.

Based on a grounded theory approach used in political ecology (Corbin and Strauss 1990), we analyzed and coded field notes, easement documents, and interview transcripts to identify social processes and relations and funding flows occurring in the development and management of the exacted easements. Following Clarke (2009), we developed a situational map for the case studies and considered the relationship between social and ecological factors impacting stewardship, management, and economic opportunity on grazed land pre-and-post an exacted easement. The most recent exacted easement, and the one we have chosen to focus on, is the Golden Hills Ecological Preserve. It includes an up-to-date listing of conservation activities, their value, and who will be paid for conducting them (Table 3). This easement also required the creation of habitat, which is true when additional habitat of a specific type is needed to meet mitigation requirements for some exacted easements.

RESULTS

Spatial analysis of grazing lands’ contribution to conservation

The spatial data layers used in this study are available from a regional planning network, the Conservation Lands Network 2.0; however, the analysis tools within the network do not support the evaluation of grazing land relative to conservation. While grazing land is the primary agricultural land use in the SFBA, land types are described in the network planning analysis tools by land cover, e.g., grassland, woodland, forest, water, urban, agriculture. As such agricultural land cover only includes cultivated agriculture. A grazing land data layer is available from the state’s important farmland database. Overlaying grazing land with land protection status, habitat for threatened and endangered species, and high conservation priorities reveals a significant contribution of grazing lands toward conservation in the SFBA.

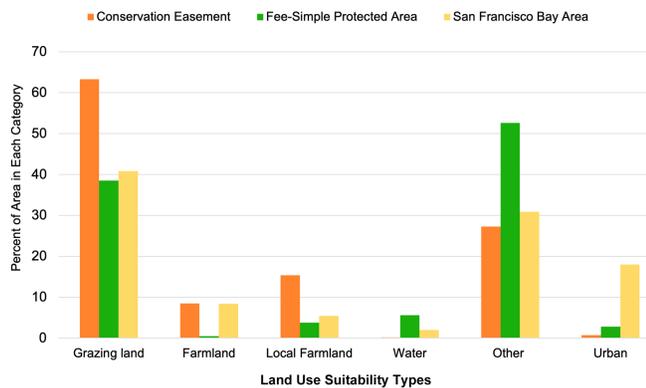
Table 3. Case study: exacted easements reviewed on working ranches in Alameda County. The Golden Hills Ecological Preserve is CR2.

Easement ID by Ranch	Year created	Project mitigated	Enhancements	Conservation values
MN1	2002	Residential development	None	Habitat for California tiger salamander
MN2	2005	Municipal golf course	None	Habitat for California tiger salamander, California red-legged frog
CR1	2009	Highway road widening	Riparian planting; wetland creation	Habitat for California tiger salamander, California red-legged frog, San Joaquin kit fox
KL1	2011	Water treatment plant construction and pipeline	None	Habitat for California tiger salamander, California red-legged frog, San Joaquin kit fox
MN3	2015	Electric switching station	None	Habitat for California tiger salamander
CR2	2018	Windmill repowering	Breeding pond expansion	Habitat for California tiger salamander, California red-legged frog, San Joaquin kit fox, and burrowing owl

Grazing land and protection status

Lands protected for conservation cover 492,709 ha or 29% of the SFBA. Grazing land, primarily rangeland, describes 41% of land in the area and 43% of the protected land. Of the land protected by public ownership or fee-simple title, 39% (157,522 ha) is grazing land (Fig. 2). More than 50% of the land protected by fee-simple title or in public ownership is other land, natural lands that are not grazing land or rangeland but include chaparral, scrub, redwood and conifer forest, and scrublands. On the other hand, grazing land is the most common land use protected by conservation easements, such that 63% of the area’s conservation easements are on grazing land, or 53,143 ha. “Working lands,” both grazed land and cultivated land, have higher percentages of land protected by conservation easements than their percent cover in the SFBA.

Fig. 2. Land use suitability types that occur on conservation easements, fee-simple properties and all land within eight-counties of the San Francisco Bay Area.



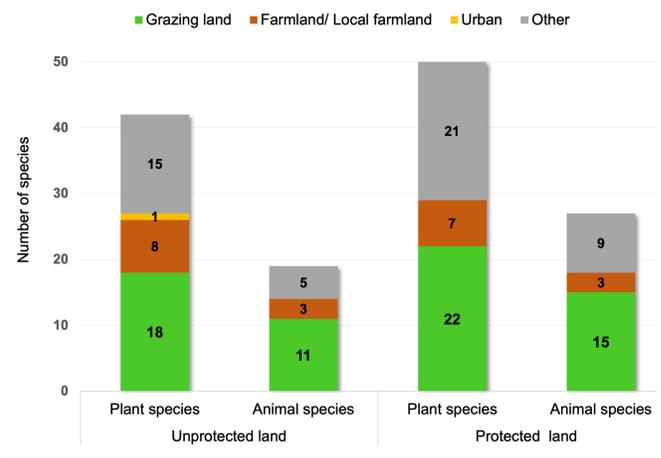
Spatial analysis of SFBA protected lands over a decade ago (Rissman and Merenlender 2008) found similar results comparing the contributions of fee-simple title and conservation easement protected lands by agricultural land use. Conservation easements were more likely to conserve working lands, largely grasslands and woodlands, whereas other lands, including chaparral, scrub, and conifer forest were more often conserved by public ownership.

Grazing land as habitat for threatened and endangered species

The assessment of land use in the region relative to habitat suitability for threatened and endangered species found that all land use types in the area provide potential habitat for some

species within 3.2 km of their known occurrence. However, among the land use types, grazing lands, whether protected or not, provide the majority of the habitat (> 50%) for the greatest number of plant and animals species (Fig. 3).

Fig. 3. Number of threatened and endangered species with greater than 50% of their potential habitat provided by a single type of land use on unprotected and protected lands in the San Francisco Bay Area.



Grazing land as priority lands for conservation

Rissman and Merenlender (2008) did not consider the relation of agricultural land uses, e.g., grazing land or farmland, to species conservation or priority conservation areas; however, they concluded that including conservation easements in spatial databases is necessary for conservation planning. Motivated by conservation of biodiversity and ecosystem functions, a regional planning effort updated in 2019, the Conservation Lands Network 2.0 provides a framework to prioritize protection. The analysis tools in the framework consider prioritized lands by land cover types, e.g., grasslands, oak woodlands, forests, wetlands, and agriculture. Agriculture as a land cover type is exclusively cultivated agriculture, excluding grazed lands. When land use types overlay conservation priority lands, grazing land represents over half of the land essential for conservation and 65% of the land categorized as important for conservation. In addition, the majority of contributing and connecting lands are grazing land (Table 4).

Table 4. Percent of unprotected[†] conservation priority land as defined in the regional conservation strategy, Conservation Lands Network 2.0., by agricultural land use type in the San Francisco Bay Area.

Conservation priority category	Grazing land	Farmland	Farmland of local importance	Water	Other	Urban
Essential for conservation	51%		6%	3%	40%	
Important for conservation	65%		3%	1%	31%	
Connecting land for conservation	73%		6%	1%	19%	
Contributing land for conservation	68%		6%	1%	25%	
Not priority for conservation	4%	30%	2%		8%	58%

[†]In this study unprotected refers to land without deed restrictions for conservation. Protected land or lands with deed restrictions include public lands and lands with permanent conservation easements.

In this analysis, agricultural lands, mostly represented by grazing land, have substantial overlap with lands identified as having high value for conservation (Table 4). Whether protected or not, grazing land in the SFBA is a primary provider of habitat for protected plant and animal species. The case study that follows considers the impact of a partial land acquisition conservation strategy on grazing, livestock production, and ranch stewardship.

Case study: exacted easements on grazing land and the Golden Hills Ecological Preserve

The exacted conservation easements reviewed in the case study were created to fulfill compensatory mitigation requirements for a variety of development projects (Table 3). Despite the difference in development projects and developers involved, the process of establishing an exacted easements and the resulting change in social dynamics are similar among the easements and are exemplified by the Golden Hills Ecological Preserve. The Golden Hills Ecological Preserve (CR2, Table 3) was created by an exacted easement on a privately owned working cattle ranch in eastern Alameda County, California to compensate for loss of habitat from a wind energy project on neighboring land. Completed in 2016, the wind energy project decommissioned and removed 775 obsolete wind turbines and replaced them with 48 larger, new-generation turbines. Because construction activities to remove and replace the wind turbines had the potential to impact state and federally listed threatened and endangered species, the United States Fish and Wildlife Service and the California Department of Fish and Wildlife required mitigation. A neighboring cattle ranch, which has been grazed by livestock and stewarded by a ranching family for the past 150 years, was found by federal and state wildlife management regulators to support quality habitat for three threatened and endangered species requiring mitigation, San Joaquin kit fox (*Vulpes macrotis mutica*; SJKF), California red-legged frog (*Rana draytonii*; CRLF), and California tiger salamander (*Ambystoma californiense*; CTS), and one species of special concern, Burrowing Owl (*Athene cucularia*). To compensate for habitat loss from their project, the wind-energy developer purchased a conservation easement on the neighboring cattle ranch and committed to creating additional breeding habitat for CRLF and CTS by expanding livestock ponds on the ranch. With agreements from a major high-tech company and medical facility in the region to buy green energy, the wind-energy developer funded the exacted conservation easement, including new habitat construction, and a non-wasting endowment.

The ranching family, interested in accessing funds to secure their ranch land for future generations, agreed to the terms of a conservation easement considered to be compatible with

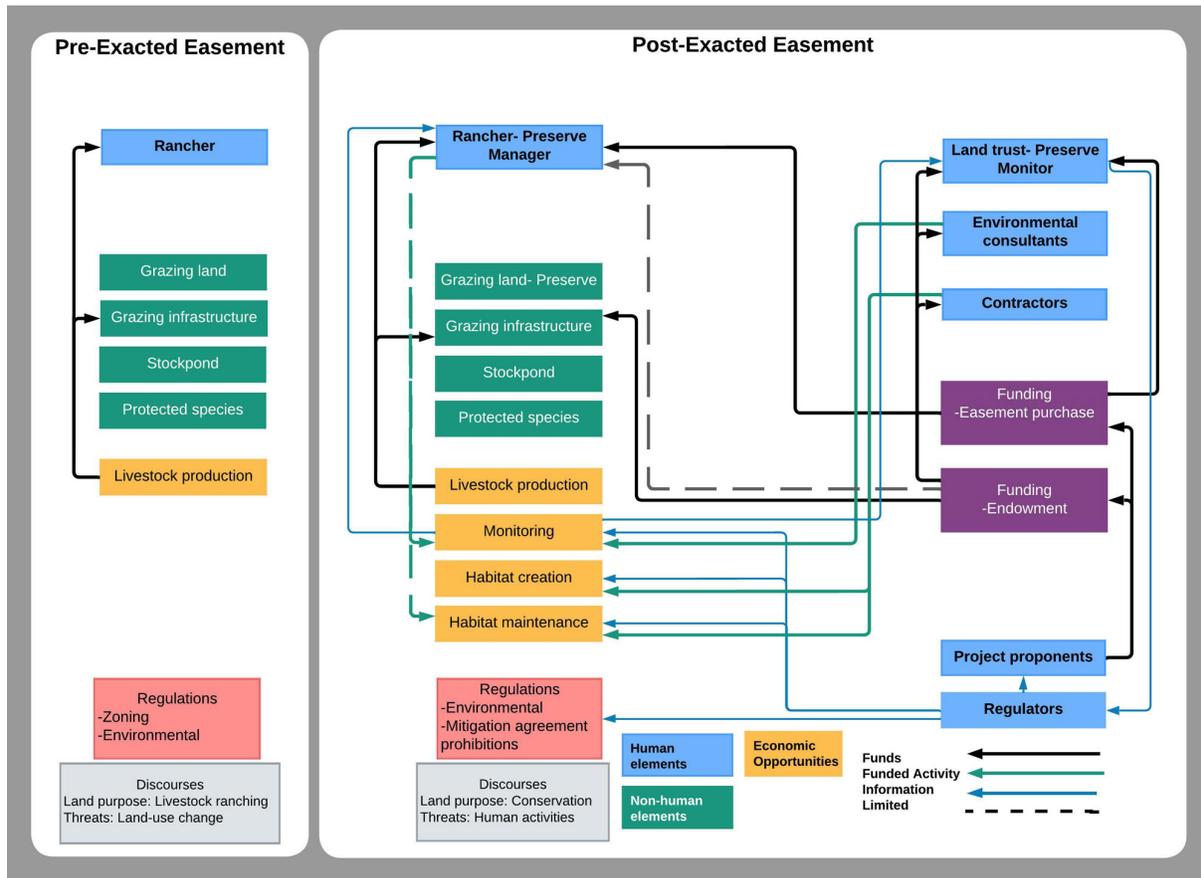
rangeland livestock production. Like other rangeland owners accepting conservation easements, they regard land stewardship practices and livestock production as fundamental to conserving the species found on their land. For example, two stock ponds within the easement area were created to provide livestock water but provide habitat for CTS and CRLF. Livestock grazing practices have maintained upland habitat with favorable vegetation structure for CLRF, CTS, SJFK, and Burrowing Owls. The family chose a non-profit, agriculture-based land trust, approved by the wildlife regulatory agencies, to hold and enforce the easement. The other easements reviewed in this study provide habitat for similar listed species on grazed rangeland (Table 3), although enhancement, e.g., creation of habitat, is not always required.

The ordered situational map illustrates relationships between human and non-human elements of the easement and the flow of funds and information supporting conservation activities pre- and post-exacted easement implementation (Fig. 4; Perez and Cannella 2011); it is, in fact, a map of changed relationships and resource flows. Through purchase of the easement, significant control over ranch resources is assigned to a third-party non-government agent, often a land trust. The land trust is required to uphold easement requirements, which were developed by environmental consultants on behalf of project developers to satisfy requirements from wildlife regulatory agencies (Fig. 4; human elements). Specification of conservation values that must be protected are a required part of an exacted conservation easement agreement, reflecting the fact that such easements mitigate for a specific conservation loss. The conservation losses determine the conservation values identified for the property. Stated as follows in the recorded easement deed, the conservation values for this easement are limited to habitat values for specific threatened and endangered species:

The Easement Area provides high quality natural, restored and/or enhanced habitat for the San Joaquin kit fox (Vulpes macrotis mutica), California red-legged frog (Rana draytonii), California tiger salamander (Ambystoma californiense), and western burrowing owl (Athene cucularia), and contains breeding, non-breeding, foraging and dispersal habitats for these species. Individually and collectively, these wildlife and habitat values comprise the 'Conservation Values.'

Unfortunately, as might be expected from the narrow focus of this type of easement, the well-recognized benefits of livestock production to these species is not included as needing support or

Fig. 4. Case study, ordered situational map of nature and social relations on grazing land pre- and post-exacted easement.



protection. Further, the exacted easements also prohibit many activities with no regard to their historical use and potential conservation value. Any agricultural activity other than grazing, such as planting, disking, or using pesticides and rodenticides, are common prohibitions in exacted conservation agreements reviewed in this case study. During the case study review period, easement requirements prohibited disking for a fuel break to protect forage and prevented control of ground squirrels even as burrows were compromising a hill slope. Easement management also excluded livestock access with fencing to some areas considered sensitive, including a stock pond and an ephemeral creek corridor. In this case, livestock exclusion led to hiring a contractor to mow an overgrowth of noxious weeds and later payment to the ranch landowner to mow the regrowth of weeds. In some cases, exceptions to prohibitions may apply if the practice will benefit conservation values based on the easement agreement and consent from the wildlife regulatory agency and the easement holder. Even so, approval is not guaranteed, and obtaining permission may prevent timely management. After three years, approval to restore open water in a stockpond to provide livestock water and support habitat for CTS and RLF has yet to be granted. Prohibitions required by the federal and state wildlife management agencies are monitored and enforced by the easement holder for perpetuity.

Creating new habitat, maintaining habitat, and monitoring to enforce prohibitions demands ongoing services, i.e., conservation activities (Fig 4; economic opportunities). These activities are funded in perpetuity at Golden Hills because they are paid from annual income generated by the endowment established for the easement (Fig. 4; funding). Non-wasting endowments are currently required by wildlife management agencies to be established for every exacted easement to cover future management and compliance costs. Only the oldest easement from the case study, established in 2002, does not have an endowment, although the developer paid a fee to the land trust to cover future monitoring activities.

Funded conservation activities include resource management, infrastructure maintenance, monitoring, reporting, and easement administration (Table 5). Some activities can only be provided by qualified resource management professionals and solely benefit habitat, such as the removal of bullfrogs, which are predators of a protected species. However, some tasks support land sharing by livestock production and conservation, including maintenance of stock ponds, management of invasive species, or adaptive management, i.e., management considered to meet conservation objectives. Several tasks, including biological surveys or monitoring, could inform management but performed by

Table 5. Conservation tasks funded by annual endowment revenue, and their purpose, beneficiary, and value to habitat, livestock, production or both (sharing) for the Golden Hills Ecological Preserve.

Funded Conservation Activities	Purpose	Economic beneficiary from task	Value
Aquatic resource / rare plant assessment	Monitoring	Consultant	Habitat
Den/ burrow monitoring and mapping	Monitoring	Consultant	Habitat
Protected species monitoring, CA red legged frog, CA tiger salamander	Monitoring	Consultant	Habitat
Invasive plant infestation monitoring	Monitoring	Consultant	Sharing
Residual Dry Matter monitoring	Monitoring	Consultant	Sharing
Photo monitoring	Monitoring	Consultant	Administration
Fence and gate replacement	Infrastructure	Landowner or Contractor	Sharing
Water system replacement	Infrastructure	Landowner or Contractor	Sharing
Signage, preserve boundary and no trespass	Infrastructure	Landowner or Contractor	Sharing
Pond maintenance (dredging)	Infrastructure	Contractor	Sharing
Wildlife management (non-native species removal)	Management	Contractor	Habitat
Easement monitoring	Monitoring	Easement Holder or Consultant	Administration
Monitoring reporting	Reporting	Easement Holder or Consultant	Administration
Accounting	Reporting	Easement Holder	Sharing
Fences and gates repairs	Infrastructure	Landowner	Sharing
Water system repair (springs, pipelines, tanks, troughs)	Infrastructure	Landowner or Contractor	Sharing
Access and fire road maintenance	Infrastructure	Landowner or Contractor	Sharing
Trash removal	Management	Rancher	Sharing
Weed management	Management	Rancher or Easement Holder	Sharing
Adaptive grazing management	Management	Landowner	Sharing
Photo monitoring	Monitoring	Rancher	Administration
Management reporting	Reporting	Rancher	Administration
Annual management meeting	Administration	Rancher/ Easement Holder	Administration

consultants they primarily provide assurance to the administration of the easement that conservation values are being upheld.

Easements developed more than a decade ago only established funding for easement monitoring, biological surveys, reporting, and replacement of grazing infrastructure where applicable. Except for funding for infrastructure replacement, e.g., replacing fencing every 40 years, third-party agents entirely conduct activities in these older agreements. The land trust must hire a qualified environmental consultant to monitor the easement and provide the rancher with information to support adaptive management. Based on monitoring reports and rancher interviews from the case study, while the ranchers conduct adaptive management, i.e., adjusting stocking rates, timing grazing to impact invasive species, or minimize impact in riparian areas, they do not rely on information from consultants to make adaptive management decisions, as annual or bi-annual reports are not useful for day-to-day management decisions. Consultant information primarily provides assurance to easement holders and regulators that conservation values are being maintained.

As borne out by analysis of all five case exacted easements in this study (Table 3), redefining a ranch as a preserve may exclude grazing or agriculture as a conservation value to be maintained. This results from an overwhelming and specific focus on mitigation of losses to the species of concern as required by environmental regulations with no real regard for the use and management activities that have contributed to the current conservation values. During the drafting of the easement agreement and conservation management plan for the Golden Hills Ecological Preserve (CR2) the ranch landowner questioned the shift of his title from “rancher” to “preserve manager:”

I am not sure why the term “rancher or landowner” is being replaced by “preserve manager,” except “preserve manager” does not acknowledge the rancher or a ranching operation.

The ranch itself was retitled from the [family name] ranch to the Golden Hills Reserve, and with the lack of mention of conservation values for grazing, this changes the apparent purpose of the property. It may also jeopardize the use and management that has created the current conservation values.

When asked, representatives of the California Rangeland Trust, a primary conservation easement land holder in California, commented that excluding grazing or ranching as a conservation value in an exacted easement is not ideal for sustaining livestock production. However, they noted that grazing is permitted by referencing the conservation management plan in the recorded easement. The Golden Hills Reserve has such a plan that includes requirements for grazing management, and when applicable, plans to maintain grazing infrastructure such as fences and watering systems. Support for grazing as a permitted land use is also provided by federal and state wildlife regulators and managers that acknowledge that agency and scientific understanding of livestock grazing impacts has shifted in recent years. A U.S. Fish and Wildlife Service (USFWS) regulator articulated this shift during the interview: “For a long time, the conservation movement was based on natural environmental systems, now we work on reconciliation ecology, encourage grazing that is beneficial to species.”

Although conservation interests may recognize a positive role for grazing, as the Golden Hills rancher put it, “They [wildlife management agencies] assume grazing will pay its way, but who will graze and provide habitat when it doesn’t work [pay its way]?”

Without livestock production specified as a value to be conserved, the needs of the livestock operation itself can be overlooked.

DISCUSSION

We have addressed the treatment of grazing and livestock production in conservation at landscape and ranch levels, identifying problems or oversights that may limit the ability to meet conservation goals for each. At the landscape scale, conservation planning efforts in the SFBA describe lands based on their vegetation cover types, not seeing land use and management when it supports nature. Urban and cultivated agricultural land uses are recognized but not grazing and livestock production that are supportive of natural landscapes. This oversight emphasizes land acquisition and state-control as a primary means to conserve and continues a fortress conservation approach where human activity is separate from nature conservation. The concept of wilderness or lands not impacted by humans has been critiqued by political ecologists who provide evidence that natural areas are socially constructed and continue to be shaped by human agency (Peluso and Vandergeest 2001, Watt 2002, Kabra 2018). Excluding grazing status in planning efforts may preclude efforts to plan for sustainable management and support land sharing that has been providing conservation.

Spatial analysis in this study showed that land sharing is an important component of protected lands in the SFBA, with significant amounts of grazed lands providing forage for the grazing community and opportunities to support conservation including habitat enhancement and fuel reduction through grazing. This land sharing approach is common regardless of acquisition status: whether title is fully (fee-simple title) or partially held by a conservation entity, grazed lands are a significant part of the portfolio.

Reterritorialization: making a preserve from a ranch

At the ranch level, exacted conservation easements are a growing part of conservation efforts in California. The study of political ecology examines nature and social relations (Robbins 2011) and can be applied to those that evolve from exacted easements and the capacity of this partial-acquisition conservation strategy to support land sharing. Reterritorialization describes a redefinition of the purpose of the land and land use that determines which activities are appropriate, and shapes who will benefit from permitted uses, and can be used to describe the changes that came with an exacted easement on the Golden Hills Preserve. Reterritorialization is described by Brogden and Greenberg (2003:291):

[W]hen an interest group redefines commodity values and achieves the power to rearrange rights to a natural resource system so that earlier commodity values become obsolete and disprivileged. It can describe a process where the state establishes control over people's activities and use of natural resources within a defined area (Braun 2000, Brugger 2014), as is the case with exacted easements because they are required by the state to meet environmental rules (Lippmann 2005). Applied to the creation of protected areas, political ecology theory has identified reterritorializations that include enclosure (exclusion), and capital accumulation (a net addition and redistribution of wealth), in displacing resource users

and enabling others to benefit from new economic values developed for nature (Corson 2011, Kelly 2011, Fairhead et al. 2012).

Exacted easements also commonly prohibit agricultural activities other than grazing, creating enclosures that limit a rancher's use and management of grazing land resources (Peluso and Lund 2011). These factors seem more characteristic of fortress conservation than land sharing strategies. Finally, the reterritorialization creates a form of capital accumulation where new sources of funding flow to third parties, including consultants and contractors.

In discussing with a USFWS federal regulator how an exacted easement will support sustained ranch viability, it was made clear that exacted easements for habitat conservation have a specific purpose. Exacted easements meet permit requirements for the preservation, restoration, and enhancement of an area, for covered species and their habitat, where covered species are the legally protected species requiring mitigation because of development elsewhere. The easement may accommodate other protections such as agricultural land preservation or watershed protection, but that is not its purpose. Unlike traditional conservation easements exacted easements always link to another law that defines its purpose; they are exacted in exchange for a permit, which allows for loss of conservation values, e.g., habitat for a development project (Lippmann 2005, Owley 2011). The regulations are decisive in protecting nature with little consideration for protecting the activities that have created and maintained the conditions for the covered species. During the development of easement documents for the Golden Hills Ecological Preserve, when the ranch landowner inquired about impacts to ranching viability, he was repeatedly informed by consultants drafting the long-term management plan that "the conservation easement's primary function is covered species." Although there is some appreciation that livestock grazing may be compatible and even beneficial, active efforts to keep production viable are not valued. Yet the loss of production would change the habitat in perhaps undesirable ways and undermine the livelihood of the landowner responsible for stewarding the land.

Enclosure: prohibited land uses and activities

In describing the mechanism of land control, Peluso and Lund (2011) recognize that enclosures restricting resource use or protecting species can impact users like physically fencing out the space. In creating conservation areas, enclosures have been recognized as dispossessing people from resource use and income (Kelly 2011). In the case study of exacted easements, landowners maintain access and use of their land, but easement prohibitions limit agricultural practices that have been supportive of livestock production from grazing land.

Although the stated conservation values may benefit from prohibiting these activities, e.g., ground squirrel burrows are used by both CTS and SJKF, the long-term impacts on ranch viability are unknown. These practices may be used infrequently or just periodically by landowners but have supported livestock production on grazed land in the region for well over a century. For example, since the late 1800s millions of acres of land have been treated annually with various toxicants to suppress ground squirrel populations (Schitoskey and Woodmansee 1978).

Ground squirrels are native to California, but they are also a major agricultural pest. Their burrows can compromise infrastructure such as roadways and dams, and in large numbers they compete with livestock for forage (Marsh 1998). The planting of non-native plants for both forage and erosion control also has an extensive history on California's rangelands (Murphy et al. 1973). Prohibitions of historical management practices as a result of the conservation easement agreement may not only impact a ranchers' ability to manage forage quality and quantity, but also hampers their ability to adapt to change including adaptation to climate change. The resulting dispossession takes place through loss of access to forage and management tools and can reduce capacity for livestock production.

Accumulation from conservation of protected species

Whereas reterritorialization through an exacted easement deprives livestock and applies enclosures restricting certain activities that may support livestock production, new economic values providing for capital accumulation from actions to conserve protected species are created and illustrated in the situational map (Fig. 4). Prior to the exacted easement, threatened and endangered wildlife species and their habitat on the ranch had no economic value. Livestock production was the sole source of income derived from grazing (Fig. 4). Creating new habitat and maintaining habitat, to fulfill permit requirements resulting from environmental regulations, demand ongoing services, i.e., conservation activities (Table 5). Conservation activities also include monitoring for compliance. Because exacted easements are created to offset loss of a public good, such as wildlife habitat, there is a duty to ensure the public of the easement's long-term viability (Owley 2011). Fully funded from the non-wasting endowment created for the exacted easement, the conservation activities provide economic value to the species being conserved. Livestock grazing may be allowed to continue and even expected to continue, but livestock production is expected to cover its costs.

Corson (2011:706) examined state territorialization in the creation of protected areas in Madagascar and found that protection or conservation enclosures can "create commodities from a variety of things previously isolated" from markets. This variety of things includes ecotourism, amenity values, and wildlife (McAfee 1999, Brogden and Greenberg 2003, Büscher 2009), and can be applied here to conservation services for wildlife protection for which there was no market value prior to the exacted easement. From Harvey's (2003) reframing of Marx's concept of primitive accumulation, capitalism continually seeks resources that can be converted to providing profit. Corson argued that ongoing capital accumulation resulting from conservation enclosures benefits third-party non-state agents. Creating a need for compliance services primarily benefits the individuals and companies providing the environmental services. The easement requirements result in ceding some authority of the ranch landowner and the government over the ranch resources to this environmental service industry. Fairfax et al. (2005) questioned the sustainability of this conservation strategy, given the motives of both the non-profit land trust and the for-profit environmental service providers. Corson (2011) argued that the future ability of both the land and its stewards to support conservation might be compromised by the accumulation of new economic values that result from the conservation enclosure and the incentives it creates.

Consultants interviewed recognized that conservation arrangements need to be compatible with livestock production to be sustainable, and they see their role as valuable in translating information between ranchers and regulators for easements to be successful in providing species conservation. One environmental consultant shared that "ranchers often do not have skills or knowledge to present information that (regulatory) agencies require." Although biological surveys and monitoring may not provide conservation outcomes, interviewed consultants and easement holders saw value in monitoring to assure compliance and defend grazing practices. As an easement holder noted, "monitoring provides defense against dogma." Still, the consultants and easement holders had concerns that monitoring was "overdone," "overthought," or "overmonitored." One noted that "it's really good for consultants."

Endowments created to serve and uphold easements certainly provide long-term benefits for conservation service providers such as environmental consultants. However, the newest agreements include funds for management, which may be conducted by the landowner, allowing them to benefit from ongoing capital accumulation, new economic values resulting from conservation. Funded management activities often benefit habitat management and livestock production, contributing to sustaining land sharing (Table 5). For example, the ranch landowner for MN3 is receiving annual payments for photo monitoring and thatch reduction resulting from managed grazing. The ranch landowner for CR1 was paid for mowing invasive weeds and removing debris left from illegal dumping. These new opportunities are varied, but easement landowners have shown that they are willing to conduct management activities to meet conservation objectives.

Landowner willingness to reorient the use of land or activities to take advantage of reterritorialization and resulting new economic opportunities has been observed on various landscapes. Some timber companies have shifted to preserve making and residential development (Olson 2016, Watson and Skaggs 2016). On agricultural lands, farmers adjusted operations to benefit from new capital and labor resulting from migration and amenity-based opportunities (McKinnon 2016). However, while ranch landowners have shown themselves to be willing to adapt management and conduct additional conservation tasks, e.g., removing debris, altering grazing practices to meet conservation objectives, the landowners in this case study see the need to continue grazing to provide for conservation and recognize that livestock production is expected to pay for itself. The ranch landowner for Golden Hills Ecological Reserve questioned the funding available for conducting adaptive management for species conservation on his easement (Table 5): "The PAR (endowment budget) only supports 8 hours per year for rancher management. The management plan is not written to support or sustain ranching but rather written as if the ranch is a preserve and the preserve manager is largely a volunteer." Ultimately, how well this new economic activity supports land sharing will depend on how funds are distributed and who gets paid to perform the conservation tasks, especially since easement restrictions may reduce landowner income from production. Grazing lands conservation value reflects the need to specifically include the livestock enterprise in conservation planning. While conservation and natural resource planning efforts are evolving to integrate multiple ecosystem services as in the InVEST (Integrated

Valuation of Ecosystem Services and Tradeoffs tool (Tallis and Polasky 2009), grazing's value is difficult to quantify and has not been included (Johnsen et al. 2021).

CONCLUSIONS

Grazing lands supporting livestock production are often overlooked as places supporting nature conservation, yet grazing lands in the SFBA and throughout California harbor numerous threatened and endangered species. Cattle ranching in California has surpassed its 250th year (Burcham 1961), and the fact that many species are found on grazing land under the stewardship of livestock producers is an indicator of the compatibility of livestock grazing and wildlife conservation today. Most lands considered essential or important for conservation in the SFBA are grazing lands. Land sharing can provide opportunities to meet conservation goals on grazed lands; however, grazing, livestock production, and rancher stewardship need to be valued for their contributions to conservation.

The exacted easement, a current land protection strategy focused on acquisition of land rights for conservation, unintentionally or simply thoughtlessly, challenges the sustainability of livestock production and its ability to contribute to habitat management and species protection. The easement deprives livestock production, which puts grazing, an ecological process that most stakeholders and wildlife agencies agree is beneficial for most of the targeted species, at risk. Utilized to fulfill permit requirements resulting from environmental laws like the state and federal Endangered Species Act, exacted easements continue a fortress conservation approach that overlooks the role of resource use and management. The resulting reterritorialization, from exacted easement, redefines land use, determines which activities are deemed appropriate, and shapes who can benefit from permitted uses.

The ongoing services required to uphold exacted easements have provided new economic opportunities resulting in capital accumulation by those authorized to carry out the services. Although third-party non-government agents have been the primary beneficiaries of capital accumulation, easement conservation values could be reoriented to prevent the erasure of the livestock enterprise and support land sharing activities that work to maintain and create habitat. In short, the contributions of grazing, livestock production, and stewardship to the conservation of rangeland ecosystems warrants in the definition of conservation values in easements on ranch land.

Responses to this article can be read online at:
<https://www.ecologyandsociety.org/issues/responses.php/13459>

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Data Availability:

The data code that support the findings of this study are openly available in Figshare at <https://doi.org/10.6084/m9.figshare.16715524.v1>. Ethical approval for this research study was granted by University of California Berkeley, approved protocol 2019-02-11864

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