UNIVERSITY OF CALIFORNIA
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Conservation Planning and Policies for California Grasslands

A Group Project submitted in partial satisfaction of the requirements for the degree of Master of Environmental Science and Management for the Donald Bren School of Environmental Science & Management

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As authors of this Group Project report, we are proud to archive it on the Bren School's web site such that the results of our research are available for all to read. Our signatures on the document signify our joint responsibility to fulfill the archiving standards set by the Donald Bren School of Environmental Science & Management.

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The mission of the Donald Bren School of Environmental Science & Management is to produce professionals with unrivaled training in environmental science and management who will devote their unique skills to the diagnosis, assessment, mitigation, prevention, and remedy of the environmental problems of today and the future. A guiding principal of the School is that the analysis of environmental problems requires quantitative training in more than one discipline and an awareness of the physical, biological, social, political, and economic consequences that arise from scientific or technological decisions.

The Group Project is required of all students in the Master's of Environmental Science and Management (MESM) Program. It is a four-quarter activity in which small groups of students conduct focused, interdisciplinary research on the scientific, management, and policy dimensions of a specific environmental issue. This Final Group Project Report is authored by MESM students and has been reviewed and approved by:

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June 2nd, 2006

Abstract:

Grasslands cover 10 million acres of California, or approximately 11% of the State's area. However, despite the large area covered by this ecosystem, it has been generally overlooked by conservation policies and environmental advocates, primarily due to the large impact of invasive Mediterranean grasses. Despite the dominance of invasive grasses this ecosystem is still important habitat for grassland dependent species, including a significant number of threatened and endangered species.

This project was designed to examine the current policies that are affecting grassland conservation. The findings would be packaged as a chapter in an upcoming textbook entitled Ecology and Management of California Grasslands. Our analyses focused on several types of policies:

Federal laws
- Endangered Species Act
- Clean Water Act

State laws
- California Endangered Species Act
- California Environmental Quality Act
- California Land Conservation (Williamson) Act

Local policies
- County General Plan documents
- County ordinances

We also used existing GIS data to determine the current extent, ownership, and management of grasslands and to provide more information on the extent of grasslands affected by various policies when data was available.

Finally, after incorporating feedback from county planning officials and others, we submitted an initial draft of our chapter to the editors for review.

Executive Summary

Introduction

Goals

The goal of this project was to identify policies, at the federal, state, and county level, and assess their effects on the management and conservation of California grasslands. Our findings are synthesized in a chapter of the University of California Press book Ecology and Management of California Grasslands (in press).

Significance

Grasslands are one of the most human-altered terrestrial ecosystems in California. Native perennial grassland types make up less than 1% of state grassland, with the balance being dominated by exotic annual grasses. Even so, grassland provides important habitat for many threatened and endangered species. In addition, sensitive elements such as vernal pools are often interspersed in grasslands.

In spite of our impressive knowledge of grassland ecology, large expanses of habitat are still being degraded, fragmented, and converted. Although grasslands occupy nearly 11 million acres of California, only 4% of extant California grasslands are in formally designated reserves. Finally, because 88% of California grasslands are privately owned, land use and land management policy resides primarily at the county and local levels, where information concerning treatment of grasslands is lacking.

A considerable need exists for a comprehensive assessment of the current state of California grassland ecosystems and their fate given a dynamic and rapidly growing population.

Methods

We conducted in depth web and literature searches to accomplish these goals. Much of our effort went into compiling and synthesizing local data from several counties with significant grassland. These data included structured phone interviews and general plan documents.

Policy Profile

The policies that we determined had the potential to impact grassland conservation are organized according to whether they originate at the federal, state, or county-level.

Federal laws

Endangered Species Act

The U.S. Endangered Species Act (ESA) plays a prominent role in California grassland conservation and management. Currently 74 grassland-dependent species, including 9 vertebrates, 14 invertebrates, and 49 plants, are listed as threatened or endangered under the ESA. However, the ESA only provides protection for plants on

federal lands. The number of federally listed species in each county ranges from 0 to 18.

Section 10 of the ESA provides exemptions, permits, and exceptions to the act's prohibitions, including permitting of incidental take. The Secretary of Interior can issue an incidental take permit in conjunction with the development of a habitat conservation plan (HCP) prepared by the applicant, an approach used extensively in California to mitigate incidental take of grassland-dependent endangered species.

Clean Water Act

The Clean Water Act section 404, which regulates fill of jurisdictional wetlands, is administered by the Army Corps of Engineers. Wetlands and vernal pool wetlands in particular can occur in or near grassland habitat, potentially increasing protection of grasslands. Federal jurisdiction over isolated wetlands and ponds was rescinded following the Supreme Court's 2001 SWANCC v Army Corps of Engineers decision. However, many of California's vernal pools, for example those at the University of California's new Merced campus, are still considered "waters of the United States" due to surface connections through swales and thus come under federal authority and section 404 processes. Those not connected are under jurisdiction of the State which may delegate responsibility to local regulatory bodies.

State laws

California Endangered Species Act

The California Endangered Species Act (CESA) complements the federal ESA by protecting species in the state not covered by the federal ESA. However, the CESA definition of take does not include "harm" or "harass," and CESA extends protection of listed plant species onto privately owned lands. Natural Community Conservation Plans (NCCPs) serve the same function under CESA that HCPs serve under the ESA, the main difference being that permitting is through the California Department of Fish and Game (CDFG) rather than the USFWS. While HCPs and NCCPs are generally similar, there are a few differences. In particular, HCPs under ESA require mitigation of impacts to the maximum extent practicable, while NCCPs require mitigation to be roughly proportional to take.

Currently 58 grassland-associated species are listed under CESA. Of these species, 13 are vertebrates and 45 are plants. There are no state-listed grassland-associated invertebrates. The number of State listed species present per county ranges from 0 to 11.

California Environmental Quality Act

The California Environmental Quality Act requires that projects be reviewed to ensure they will not cause a significant environmental impact. Generally, significant environmental impacts as defined under CEQA must either be avoided or mitigated. CEQA allows counties to set thresholds of significance when determining significant environmental impact. Furthermore, counties can create resource protection ordinances with specific thresholds that can be used as the thresholds of significance

in CEQA. A further analysis of how to use the cumulative impact section of CEQA could be used to mitigate the effects of development of grassland ecosystems.

California Land Conservation (Williamson) Act

The Williamson Act empowers county governments to offer contracts to private landowners to preserve land for agricultural and open space use under ten year contracts. In exchange, landowners receive a reduced property tax assessment for the duration of the contract. Of the nearly 27 million acres of agricultural land in California in 2002, nearly 11 million acres – or about 11% of California – is held under Williamson Act contracts as non-prime farmland, which is used primarily for less intensive agriculture such as grazing, and has the capacity to protect grassland from conversion.

Local planning documents

County General Plan documents

Counties have authority to create policies and ordinances that dictate land use. These policies are specified in general plan documents, which the state requires counties to create and maintain. The mandatory plan elements of highest significance to grassland conservation are the land use, open space and conservation elements. Many counties choose to combine two or more of these elements into a single section of their general plan.

Our assessment of these policies is based on a review of sixteen readily available general plans. Within these plans, nine of the open space elements, ten of the conservation elements, and four of the land use elements recognized the biological significance of grasslands generally, or native grasslands specifically. In addition, eleven surveyed counties had optional agricultural elements, of which four discuss grasslands with regard to rangeland and other low-intensity agricultural uses.

Zoning Ordinances

Counties implement the policies in their general plans through zoning ordinances. Zoning ordinances are implemented according to the goals and policies found in general plan elements. The zoning types most likely protect grassland from conversion are those that promote large lot size or low housing densities such as open space, agriculture, and very low density residential as these leave much of the habitat intact. In current general plans more than 80% of grasslands fall in one of these three categories, with 54% of grasslands presently zoned for agricultural use and nearly 20% zoned for open space.

Private Conservation Initiatives

Financial incentives are playing an increasingly important role in the protection and management of privately owned grasslands. Public agencies and conservancies such as The Nature Conservancy, the Trust for Public Land, the California Rangeland Trust, and dozens of county and local land trusts have already invested hundreds of

millions of public and private dollars to protect grasslands through conservation easements and outright acquisition.

To a large extent the future of California grasslands depends on these and other private land management priorities and approaches, including tax incentives, direct funding, technical assistance, regulatory streamlining, ecosystem services, and incentives.

Conclusion

A large number of policies currently operate to influence the future of grasslands in California. Regulations such as ESA and CESA focus on biological management, while policies in county general plans and zoning ordinances focus primarily on agricultural management, which is a less rigorous and long-lasting form of protection. Non-regulatory financial incentives protect land from conversion through acquisition and easements, which can have a wide range of management goals.

The association of grasslands with wide ranging endangered species like the California condor and San Joaquin kit fox, as well as locally important species such as Stephens' kangaroo rat and Bay checkerspot butterfly has led to the establishment of large grassland reserves in many areas of the state undergoing large-scale development, with the trend being towards larger, sub-county or county-wide biological conservation programs. The ESA and CESA are currently the major drivers of biologically-oriented grassland protection in urbanized and urbanizing areas of California.

At the county level grasslands are viewed primarily as an agricultural resource. County zoning ordinances can prevent development of grasslands by regulating land use. Because of the extent of privately owned grassland area zoned as open space or agriculture, this provides a substantial level of protection from higher intensity land uses and urbanization. Still, agricultural and open space zoning designations are a less reliable and non-permanent source of protection, since the management goals of these areas may not align with the goal of protecting the ecological integrity of grasslands. This can cause grasslands to become preferred areas for development given increasing restrictions on development in prime farmland, oak woodlands, and coastal sage scrub communities.

Because the majority of grassland in California privately owned, private conservation initiatives are seen as one of the most important methods of future protection. NGOs can help to meet biological goals for grasslands by incorporating management practices into easement contracts, thereby involving private landowners in management decisions while affording recognition of the biological importance of grassland ecosystems.

Ecology and Management of California Grasslands: Chapter 16

Conservation Planning and Policies for California Grasslands

Patrick A. Jantz, Bernhard F. L. Preusser, Jesse K. Fujikawa, Joseph A. Kuhn, Christopher J. Bersbach, Jon Gelbard, and Frank W. Davis

1. Introduction

In this chapter we review the current environmental policy setting for conserving and managing grassland ecosystems in California. Our review is motivated by several considerations. Grassland ecosystems are perhaps the most human-altered terrestrial ecosystem nationally and in California but have been relatively overlooked in terms of conservation policy, especially in the western U.S. (Connor et al. 2001). In spite of our impressive knowledge in grassland ecology and management, large expanses of habitat are still being degraded, fragmented, and converted to agriculture and subdivisions (Holland and Keil 1995, Stromberg and Griffin 1996, Harper et al. 1998, Gelbard 2003). Only 4% of extant California grasslands are in formally designated reserves (Davis et al. 1998). Finally, because more than 80% of California grasslands are privately owned, land use and land management policy resides primarily at the county and local levels. We are not aware of any previous efforts to review and synthesize the spectrum of current policies that could affect future ecological trends in California grasslands. Given the rapid pace of change in this ecosystem type, such a review seems especially timely.

Based on recent statewide mapping efforts, grasslands cover nearly 11 million acres of California or almost 11% of the state (Davis et al. 1998, California Department of Forestry and Fire Protection 2002) (Figure 1[1]). More than 99% of mapped grassland, which excludes vegetation with more than 10% tree or shrub cover, is classified as annual grassland, with the balance consisting of perennial

[1] All figures, tables, and appendices are included at the end of this document.

grassland. This data underestimates the amount of perennial grasslands, which often occur in small patches below the resolution of statewide maps. Oak woodland and savanna ecosystems, which comprise another 5-6% of the state, also encompass extensive grassland habitat, but the presence of the tree stratum places these ecosystems into a different sociopolitical and ecological context because of the special conservation attention afforded oaks as well as their pronounced influence on wildlife and plant community assemblages (Giusti et al. 2004). For these reasons we exclude oak woodland types and focus our analysis on Mediterranean-climate grasslands, excluding desert and Great Basin grasslands of eastern California that fall outside of the California floristic province. It is not possible with existing statewide data to discriminate among different grassland community types or to distinguish between grasslands dominated by native versus exotic species, so we have treated all grasslands in the study region as "California grasslands."

First we summarize the hierarchy of federal-to-local land use policies that potentially affect the use and management of California grassland. Next we examine how these policies are currently being applied to grasslands and grassland associated species, focusing on county-level patterns and outcomes. Lastly, we examine existing and emerging conservation incentives for private grassland managers as a complement to regulatory approaches. We evaluate policies and incentives based on the protection they afford to the biological integrity of grassland ecosystems. We conclude by offering recommendations for future policy needs and opportunities.

2. Policy Framework

Article 6 of the constitution gives the federal government ultimate authority over the laws of the United States. The tenth amendment delegates unassigned powers – as well as those not prohibited by the federal government – to state governments. Article 7 of the California state constitution affords county- and city-level governments with the power to make and enforce laws not specifically in conflict with existing state laws. Table 1 reflects this delegation of powers, and the potential impact that it has on the protection of California grasslands. Policies are organized roughly in descending order of magnitude of protection, as determined by a combination of the strength of protection afforded to grasslands and the approximate grassland area protected.

Federal Authority

Roughly 9% of California grassland is owned and managed by the federal government, including 2.1% Department of Defense (DoD) and 7.1% non-DoD lands (Table 2). Examples of extensive grassland areas under federal management include the Carrizo Plain National Monument (Bureau of Land Management (BLM), San Luis Obispo County), the Panoche and Tumey Hills (BLM, Fresno County), and Beale Air Force Base (Yuba County). Management of livestock grazing and off-road vehicle use remain contentious issues on many non-DoD federal lands. Many of the areas mapped as perennial grasslands occur on DoD lands, in particular Camp Pendleton.

The U.S. Endangered Species Act (ESA) plays an especially prominent role in California grassland conservation and management. Section 7 of the ESA requires federal agencies that authorize, fund, or carry out an action to consult with the Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) to "insure that actions authorized, funded or carried out by them do not jeopardize the continued existence" of listed species (Goble et al. 2005). Section 9 prohibits any person from taking or engaging in commerce in endangered species, thereby extending the protection of endangered animal species to privately owned lands. Section 10 provides exemptions, permits, and exceptions to section 9's prohibition, including permitting of incidental takes as long as they do not jeopardize the continued existence of the species.

Under Section 10, the Secretary of Interior can issue an incidental take permit in conjunction with the development of a habitat conservation plan (HCP) prepared by the applicant, so long as the proposed project does not "appreciably reduce the likelihood of the survival and recovery of the species in the wild" (ESA sec. 10(a)(2)(B)). The HCP process has been used extensively in California to mitigate incidental take of endangered species, including grassland-dependent species, and has thereby directly affected grassland conservation in many areas of the State. For development to proceed within the established HCP area, HCPs require minimization of impacts and mitigation of remaining impacts to the maximum extent practicable. This is often handled through privately owned mitigation banks, which protect similar

habitat in another location and then sell mitigation credits that allow for the development of otherwise protected habitat.

The Clean Water Act section 404, which regulates fill of jurisdictional wetlands, is administered by the Army Corps of Engineers. Wetlands and vernal pool wetlands in particular can occur in or near grassland habitat, potentially increasing protection of grasslands. Federal jurisdiction over isolated wetlands and ponds was rescinded following the Supreme Court's 2001 SWANCC v Army Corps of Engineers decision. However, many of California's vernal pools, for example those at the University of California's new Merced campus, are still considered "waters of the United States" due to surface connections through swales and thus come under federal authority and section 404 processes. Those not connected are under jurisdiction of the State which may delegate responsibility to local regulatory bodies.

The Conservation Reserve Program (CRP) is a voluntary program to remove sensitive and erodible cropland and pasture from agricultural production. Farmers enroll their land for 10 or 15 years in exchange for rental payments to compensate for lost revenue. The enrolled acreage is planted with natural, although not necessarily native, cover to reduce erosion and provide wildlife habitat. According to the USDA Economic Research Service, as of 2005, 144,438 acres of land in California were in CRP contracts. Of these, 126,760 acres were in either grass or legume cover.

State Authority

The state of California owns and manages roughly 1.2% of California's annual grasslands (Table 2) (Davis et al. 1998). Noteworthy examples include the annual grasslands of the Department of Fish and Game's Carrizo Plain Ecological Reserve and coastal grasslands at Montana de Oro State Park (San Luis Obispo County) and Wilder Ranch State Park (Santa Cruz County). Most state parks are managed as nature reserves and/or for public recreation.

The University of California's Natural Reserve System manages several significant grassland areas for research, education and conservation, notably the Jepson Prairie Reserve (Solano County), McLaughlin Natural Reserve (Napa, Lake and Yolo Counties) and Sedgwick Reserve (Santa Barbara County). The Jepson Prairie Reserve includes extensive native grassland and vernal pool complexes and the latter two reserves include extensive areas of serpentine grassland.

The State of California creates legislation in a similar manner to the federal government; with the limitation that state law cannot contradict or relax any existing federal statute. State law also frequently shapes county-level legislation and mandates county-level management responsibilities.

The California Endangered Species Act (CESA) mirrors the federal ESA in many ways. However, CESA's definition of take does not include "harm" or "harass," and CESA extends protection of listed plant species onto privately owned lands (ESA §9(a)(2) and CESA §2062, §2068). Natural Community Conservation

Plans (NCCPs) serve the same function under CESA that HCPs serve under the ESA, the main difference being that permitting is through the California Department of Fish and Game (CDFG) rather than the USFWS.

County Authority

County parks, water districts and open space districts account for less than 1% of California lands, although some parks and utility districts protect significant native grasslands. Examples include the East Bay Regional Park District's Point Pinole Park (Contra Costa County) and Redwood Regional Park (Alameda County), the East Bay Municipal Utility District's

Siesta Valley watershed management area, and the Ramona Grassland Preserve (San Diego County).

Counties have authority to create policies and ordinances that determine how land can be used and what conditions can be placed on use. County land use goals and policies are specified in general plan documents, which the state requires counties to create and maintain. General plans include both mandatory and optional elements. The mandatory elements are land use, circulation, housing, open space, conservation, safety and noise. Land use, open space and conservation elements have special relevance to conservation and other policies that may affect grasslands. Examples of optional elements with potential to impact grasslands include agriculture, scenic highways, and biological resources.

General plans are binding documents, but are routinely amended to accommodate changing county needs. The goals and policies of the general plan are implemented by county zoning ordinances. These ordinances specify the actions in which land owners may engage and the use to which land may be put. For instance, they specify allowable densities for different land use types in the county.

County governments are conferred the authority to implement the California Environmental Quality Act (CEQA), the California Land Conservation Act (usually referred to as the Williamson Act, after author John Williamson), and the California Coastal Zone Conservation Act. Counties are required to implement CEQA. Generally, significant environmental impacts, as defined under CEQA, must either be avoided or mitigated. CEQA allows counties to set thresholds of significance when determining significant environmental impact. Furthermore, counties can create resource protection ordinances with specific thresholds that can be used as the thresholds of significance in CEQA.

The Williamson Act empowers county governments to offer contracts to private landowners to preserve land for agricultural and open space use in exchange for a reduced property tax assessment. Williamson Act contracts limit contracted parcels of land to agricultural uses for ten years, after which time the contract is automatically renewed unless the landowner files for non-renewal at least nine years prior to the contract's expiration. The Williamson Act also provides for the establishment of Farmland Security Zones (FSZs), which put land under contract for twenty years in return for greater property tax reduction.

The Coastal Act establishes a permanent coastal zone management program at the state level, with the authority to prepare coastal plans delegated to coastal counties and cities. Coastal plans are adopted as an element of coastal counties' general plans, and are intended to protect and enhance coastal resources. Locally developed plans are reviewed by the Coastal Commission every five years.

3. Current Regulatory Setting in Relation to Grassland Status and Trends

The Federal Endangered Species Act and California grasslands

Currently 75 grassland-dependent species, including 10 vertebrates, 14 invertebrates, and 51 plants, are listed as threatened or endangered under the ESA (Appendix 1). However, the ESA only provides protection for plants on federally owned lands (ESA §9(a)(2)). On a county basis, the number of federally listed species associated with grassland habitat ranges from 0 to 18 (Figure 2a). Unfortunately, the total habitat area affected by the listed species has not been determined on a consistent basis.

Approved and proposed HCPs for grassland dependent species range in size from small plans covering a single species, such as the Wildcat Line LP HCP in Monterey County which only covers Smith's blue butterfly in a planning area of 11.5 acres, to large sub-county plans such as the East Contra Costa County HCP/NCCP protecting at least 23,500 acres (~19,000 ac. of grasslands), to county-wide and multi-county plans covering both listed and non-listed species. An example of the latter is Solano County's HCP/NCCP, which covers 25 listed species, eight of which are

grassland associated, as well as 51 non-listed species (http://www.scwa2.com/hcp.html).

While numerous grassland associated species have been included in HCPs, there are a few species that appear more often than others, including San Joaquin kit fox (*Vulpes macrotis mutica*), blunt-nosed leopard lizard (*Gambelia silus*), and California red-legged frog (*Rana aurora draytonii*). Some species such as the San Joaquin kit fox and the California condor (*Gymnogyps califonianus*) serve as "umbrella species" due to their large area requirements. For example, the kit fox figures prominently in the design of HCP, MSHCP and NCCP reserves and habitat corridors in East Contra Costa, Santa Clara, western Stanislaus, San Joaquin and Kern Counties.

Increasingly, plans are designed to meet the requirements of both the HCP and NCCP planning process. Of the 97 approved HCPs and NCCPs in California listed on the USFWS and CDFG websites, 42 of them affect grassland species (Table 3). These plans cover nearly four million acres, and plans covering more than seven million additional acres are currently being developed. It should be noted that these are the total planning areas of the HCP/NCCPs, and include areas that are not part of habitat reserves.

Inclusion in an HCP/NCCP does not necessarily ensure strong protections for grasslands or grassland species. In the case of the San Diego Multiple Species Conservation Program (MSCP), for example, grasslands are just one of 26 natural vegetation communities in the plan area. In this case, grasslands were clearly not the

main focus of the plan, which was especially concerned with the coastal sage scrub ecosystem. The Biological Opinion for the San Diego MSCP classifies native grasslands as a Tier I habitat and non-native grasslands as a Tier III habitat type (more mitigation is required for Tier I habitat than for Tier III habitat). This is expected to lead to higher levels of preservation for native grasslands than for non-native grasslands.

The Clean Water Act and California grasslands

Although it specifically addresses wetlands, Section 404 of the CWA can affect grassland conservation to the extent that grassland adjacent to a federal jurisdictional wetland is less likely to be developed due to the 404 permitting process restricting dredging or fill. Most of California's vernal pools occur in grasslands and CWA as well as ESA (and to a lesser extent the U.S. Migratory Bird Treaty Act) protections have led to some conservation of vernal pool/grassland complexes in areas such as western Merced County. Perhaps more important has been the application of federal Clean Water State Revolving funds to protect grassland/vernal pool complexes. For example, agencies, land trusts and conservancies have collaborated to protect more than 40,000 acres of vernal pool landscapes in the Central Valley (http://www.epa.gov/owow/wetlands/pdf/state_rev_fund.pdf).

When the vernal pool or wetland is not deemed "waters of the United States", the permitting process is conducted variously by the counties. The extent of wetland buffer zones also varies depending on wetland type, the specific jurisdiction, or county (National Academy of Sciences 2001). Often the wording of the policy

specifies a distance within which removing, filling, dredging, or altering certain resource areas such as vernal pools is prohibited. By virtue of its presence in the landscape, vernal pool habitat has the potential to conserve large areas of grasslands, either through federal 404 or county level jurisdictional permitting processes.

The California Endangered Species Act and California Grasslands

Currently 58 grassland-associated species are listed under CESA. Of these species, 13 are vertebrates and 45 are plants (Appendix 1). There are no state-listed grassland-associated invertebrates.

As with the federal ESA, the level of protection afforded to grassland habitat by CESA varies by county based on the number of listed species present. The number of state listed species present in any given county ranges from 0 to 11 (Figure 2b). The extent of habitat for these species within each county has not been consistently estimated.

The effects of NCCPs on grasslands are similar to the effects of HCPs. As was discussed in the federal ESA section, there is considerable overlap between HCPs and NCCPs and there are many similarities between the two types of plan. Both require minimization of impacts and limit take to levels that will not endanger the survival of the species. Both also require that adequate funding be guaranteed before the plan is approved.

While HCPs and NCCPs are generally similar, there are a few differences. In particular, HCPs under ESA require mitigation of impacts to the maximum extent practicable, while NCCPs require mitigation to be roughly proportional to take.

County General Plans and Policy Documents

Our assessment is based on a review of readily available county policy documents such as general plans and zoning ordinances, and phone and email interviews with county planning departments. We limit our survey to 21 counties that account for 76% of the total grassland area in California (Appendix 2).

Conservation Element

California Code section 65302(d) requires that a conservation element be present in all county general plans. This element provides guidance for the conservation, development, and utilization of natural resources within the county. Counties frequently combine this element with the open space element of their general plan.

The county conservation element often identifies specific habitats of concern such as wetlands, rare plant community types and habitat for sensitive species. Fourteen of the counties we examined had readily available conservation elements, of which six were combined conservation/open space elements. Of these, five of the conservation elements and five of the combined elements recognized grasslands and/or native grasslands. The Kern County general plan combines land use,

conservation, and open space elements and contains no recognition of grassland ecosystems (Appendix 3).

When grasslands are mentioned in the conservation element of the general plan it is often in context of preserving significant natural areas. For example, in Madera County's combined natural resources and agricultural element Policy 5.F.3, grassland could be included in "natural areas of outstanding vegetation." In practice Madera County's policy is implemented by maintaining a list of significant species, including species listed under CESA, species included in the California Native Plant Society's Inventory of Rare and Endangered Plants, and Department of Fish and Game species of special concern. The list is kept current to fulfill the requirements of federal and state endangered species laws and to guide the county's efforts in conserving important natural areas.

Instead of providing additional protections, conservation elements generally defer to federal and state regulations. However, some counties appear to be moving toward more proactive grassland conservation. The 2004 Monterey County general plan update, for example, contains language that would give special protection to native perennial grass habitat within the county. If the draft plan is approved, coastal terrace prairie/valley needlegrass grassland will be defined as an environmentally sensitive area, which "shall be protected against any significant disruption of habitat values" according to policy CZ-5.2.

Open Space Element

California Code Section 65302(e) requires each county to provide a plan for comprehensive and long range preservation and conservation of open space land within its jurisdiction. This element is frequently combined with the conservation element in the general plan. Grasslands can in principle be protected by open space land use restrictions. However, open space land can be managed for varied uses ranging from natural resource production to outdoor recreation or the promotion of public health and safety.

Out of the 21 counties surveyed, 16 had readily accessible general plans. All of the plans we examined contained either open space elements or combined elements that included open space information and policy goals. Grasslands and/or native grasslands specifically were recognized in four open space elements, as well as the five combined elements discussed already (Appendix 3). For example, Fresno County's policy OS F.6 stipulates that "the County shall require that development on hillsides be limited to maintain valuable natural vegetation, especially forests and open grasslands, and to control erosion". Sonoma County's Open Space Element 3.1 designates critical habitat areas that "require special protection because they are highly sensitive to change and could be adversely affected by development," including vernal pools, native bunch grasses and oak savannahs.

Currently 2,081,150 acres of grassland – 2% of the state land area and 19% of all California grasslands- are in open space designation (Table 4). The ecological significance of this designation is difficult to ascribe given the wide range of

management goals for these areas. In the longer term, as in the conservation element, open space affords little protection in excess of what Federal and State regulations supply.

Land Use Element

California Code section 65302(a) requires a general plan land use element that "designates the general location and intensity of housing, business, industry, open space, education, public buildings and grounds, waste disposal facilities, and other land uses". Of the 16 general plans we examined, 15 had land use elements and one had a combined land use, open space, and conservation element. Grasslands were recognized in four of the available land use elements, usually associated with agricultural and historical land uses within county boundaries. No land use elements included recognition of native grasslands (Appendix 3). In the Paradise Urban Reserve area of Butte County, for example, native grasslands are recognized as part of the heritage and aesthetic environment of local communities.

More broadly, the land use element provides guidance for zoning densities for particular land uses, as will be discussed at greater length below.

Optional Elements

Agricultural Element. Twenty-six counties have adopted agriculture elements in their general plans including 11 of the 22 counties we investigated. Agriculture elements are primarily designed to protect and promote agriculture and use a variety of approaches to accomplish these goals. These approaches include technical assistance to farmers, establishing agricultural support zones to ensure the economic

viability of agricultural operations, promoting agricultural products, and striving to minimize the conflict between residential and agricultural areas.

Because a large percentage of California's grasslands are found in agriculturally zoned grazing lands (Table 4), agriculture elements can have significant effects on grassland ecosystems. Land use restrictions for preservation of agricultural lands can keep residential development from encroaching on grasslands. On the other hand, policies that promote retention of prime farmland over less valuable rangelands may direct development onto grasslands.

Few agriculture elements directly address grassland or native ecosystems and none mentions grasslands or native ecosystems in agriculture element policies. Merced County mentions "native pasture" when describing trends in land conversion. Stanislaus County mentions "native ecological systems" and "grasslands" in appendix C and appendix A, respectively.

Coastal Element. Under the California Coastal Act Section 30108.55, local governments are permitted to prepare coastal plans in order to protect, maintain, and enhance coastal zone resources, plan for public recreation in the coastal zone, and coordinate between local and state initiatives that affect the coastal zone.

Grasslands are occasionally mentioned in county coastal plans. The Mendocino County coastal element, for example, acknowledges the presence of grassland habitat within the coastal zone, but does not recognize native grassland as a habitat of special consequence, or afford any special protections to coastal grassland

systems. Alternatively, the Santa Barbara county coastal element lists specific coastal management areas in which native grassland species are known to exist.

Other Optional Elements. Optional elements that may affect grassland ecosystems include resource conservation, scenic highways, growth management, parks and recreation, and biology elements. Counties that have scenic highway elements include Butte, Madera, Mariposa, Mendocino, Sacramento, San Benito, Shasta, and Tehama. The contents of this element are often paralleled in the mandatory elements of other counties, especially the open space element. Scenic highway policies often overlap with grassland systems, but generally only limit zoning density in included regions rather than forestalling development entirely. None of the counties examined had a growth management or parks and recreation element that afforded any special recognition to grassland or native ecosystems. None of the counties that we examined had biological elements in their general plans.

Zoning

Zoning ordinances are a reflection of the goals and policies found in general plan elements. Thus the lack of specific attention to grasslands in the general plans is mirrored in zoning ordinances. The zoning types most likely to indirectly preserve grassland habitats are those that promote large lot size or low housing densities such as open space, agriculture, and very low density residential. In current general plans more than 80% of grasslands fall in one of these three categories, with 54% of grasslands presently zoned for agricultural use and nearly 20% zoned for open space (Table 4).

Grasslands and the California Environmental Quality Act

The two areas of CEQA review of particular relevance are the agricultural and biological criteria. Agricultural impacts are considered significant if they conflict with Williamson Act contracts or could result in the conversion of farmland to non-agricultural use. Because large areas of grassland are either under Williamson Act contracts, included in agricultural zones, or adjacent to agricultural areas, CEQA review has the potential to influence large areas of grassland.

Significant biological impacts in grasslands occur when projects threaten sensitive species or habitat types. These include candidate, sensitive, or special status species identified in regional or local plans or by the CDFG or USFWS, sensitive communities identified in regional or local plans or by the CDFG or USFWS, areas covered by CWA Section 404, wildlife corridors, or conflict with approved habitat conservation plans. In addition, public agencies may use other criteria, such as listing by the California Native Plant Society (CNPS), to determine the rareness or sensitivity of biological resources.

Annual grasslands are generally not considered sensitive communities and are unlikely to receive protection from CEQA, unless individual species of concern, such as endangered animals or plants, are associated with them. For example, the County of Santa Barbara Environmental Thresholds and Guidelines Manual states that impacts to "small acreages" of non-native (annual) grassland are not considered significant if "wildlife values are low." Certain native grassland communities, valley needlegrass for example, have been identified as rare by the CDFG and come under

CEQA review. For such communities, thresholds of significance, which are applied on a case by case basis, will determine whether project impacts are significant enough to require mitigation or avoidance.

In the absence of explicit guidelines, public agencies use their own best judgment to determine the status of biological resources and impacts to them. Inventorying and listing of significant grassland communities by county agencies, in combination with scientifically based thresholds of significance, would increase the likelihood that impacts to such communities would be avoided or mitigated. The County of Santa Barbara Environmental Thresholds and Guidelines Manual defines native grasslands as containing at least 10% native grass cover. This specific guideline is used with the general CEQA guidelines to determine significant impact to native grassland communities in the county.

Counties can also define cumulative impact thresholds, which could help mitigate the piecemeal development of annual grasslands. For example, a county could define some proportion of its total grassland area which it desired to retain. Individual projects and their cumulative impacts could then be evaluated relative to this threshold. This would essentially set an upper limit on the amount of grassland developed in the county. However, for such policy actions to occur, county recognition of the biological importance of annual grasslands would need to increase.

Williamson Act

Currently all California counties except Del Norte, San Francisco, Inyo and Yuba offer Williamson Act contracts. Of the nearly 27 million acres of agricultural

land in California in 2002, slightly more than 5 million acres were classified as prime farmland. Close to another 7 million acres were classified as important farmland of other types. The balance, roughly 14 million acres, was classified as non-prime grazing land, which does not require high quality soil types. Nearly 11 million acres – or about 11% of California – is held under Williamson Act contracts as non-prime farmland. In the eight counties for which GIS data are available (Fresno, Glenn, Humboldt, Madera, Sacramento, San Benito, Santa Barbara, Tehama) an average of 64.6% of the total grassland area is held under Williamson Act contracts (Table 5).

In recent years the acreage held under Williamson Act contracts has remained relatively stable. In the period from 1990-2003, acreage increased only slightly, from 15,969,159 acres in 1990 to 16,560,132 acres in 2003, but these numbers do not reflect changes to the spatial layout of holdings. Some landowners may choose to file for non-renewal when the profit of developing land exceeds the tax savings under the Williamson Act, while speculators may purchase land far from existing urban centers and place it under contract in order to hold it at a reduced tax rate until development becomes profitable.

Policy Interactions

There are significant interactions among federal, state and county policies. For example under CEQA it is up to the counties to set thresholds for determining significant biological impacts. This is usually done by identifying communities or species of concern, though other methods are also available. Similarly, the

Williamson Act is often closely related to the general plan. Some counties specifically encourage entry into Williamson Act contracts in their general plans. Humboldt County Agriculture Element Policy 2523, for example, states that "1. Agricultural lands shall be conserved and conflicts minimized between agricultural and non-agricultural uses …by broadening the utility of agricultural preserves and the Williamson Act Program to accommodate and encourage intensely managed farms." (Humboldt County Community Development Services Department Planning Division 1984). In addition, counties can use their authority under the Williamson Act to encourage preservation of significant open space lands and wildlife habitat by including such areas in Agriculture Preserve delineations, which circumscribe lands eligible for enrollment in the program.

ESA, CESA, and CEQA play somewhat complementary roles in conserving grassland habitats. The ESA has strong prohibitions against indirect take but does not apply those protections to plants, whereas CESA has weaker indirect take provisions but stronger plant protections. ESA and CESA provide protection to listed species, while CEQA applies to species of concern which have not yet been listed and therefore do not receive protection from the other regulations. More generally, ESA, CESA and CEQA strictures are forcing counties to reexamine their land planning approaches to take fuller account of wildlife and natural resource issues that have traditionally been the domain of state and federal resource agencies (Scott et al. *In Press*).

4. Additional Tools for Grassland Conservation on Private Lands

Several important conclusions can be drawn from the preceding analysis of public policies and regulations. First, most grasslands are privately owned and at least two of every three grassland acres are zoned for agricultural use, open space (Table 4) and/or managed under Williamson Contracts. To a large extent the future of these grasslands depends on private land management priorities and approaches. Second, in areas where grasslands are under the greatest pressure of land development, notably in the Bay area, southern San Joaquin Valley, Riverside Basin and the South Coast, hundreds of thousands if not millions of acres of grassland are being protected as habitat for endangered species. The future of grasslands in these areas depends largely on the design and ongoing management of habitat reserves, which at best is a contentious and expensive negotiated settlement between the agencies and stakeholders (Davis et al. 2005). Third, in the absence of regulated species, grassland ecosystems, particularly annual grasslands dominated by non-native species, are protected mainly for open space or rangeland values. Such protection will certainly contribute to conserving habitat for many grassland-dependent species, although in the absence of explicit biological management goals and ecological monitoring the extent of conservation remains conjectural. Furthermore, given increasing restrictions on development in prime farmland, oak woodlands, and coastal shrublands, grasslands could receive an increasing share of development in the future. However, there are a number of other mechanisms for promoting sustainable use and restoration

of grassland ecosystems that are being increasingly applied in California, as discussed below.

Socioeconomic Benefits of Grassland Conservation

Many private landowners currently perceive conservation measures as unfairly expensive and a threat their livelihood, freedom, and property rights (Ling 1998, Esseks and Drozd 2002). To help alleviate these concerns there are several organizations that promote conservation from an agricultural land user's view point, including the California Rangeland Trust and American Farmland Trust. Even those who are interested in conservation actions typically lack the time, money, and technical expertise to implement them (Ingram and Lewandrowski 1999). In addition, they are often unaware of both the significant benefits that such actions can bring them, including economic benefits and the incentive programs that are available to help make conservation actions both affordable and money saving (Ingram and Lewandrowski 1999, Phillips 2001, Balmford et al. 2002).

Conservation actions can help landowners avoid economic costs of poor land management, boost profits, and generate new income opportunities (Richards and George 1996, Balmford et al, 2002). For example, overgrazing that causes weed invasions (Hobbs and Humphries 1995) may increase control costs and reduce land value and livestock forage capacity (Sheley and Petroff 1999, Naylor 2000). Weeds cost the State of Montana $100 million per year, and an invasion reduced the real estate value of one ranch by nearly 60% (Sheley et al. 1998). Costs may also include water loss. Gerlach (2004) estimated that in the Sacramento River watershed alone,

yellow star thistle may cause losses of soil moisture of 15-25% of mean annual precipitation, with the cost of lost water estimated to range from $16-75 million (U.S.) per year. Devising a management plan that minimizes invasions can simultaneously reduce these costs, boost profits, and benefit native species and ecosystem processes (Hobbs and Humphries 1995, Mack et al. 2000, Naylor 2000, Phillips 2001).

Conservation actions can also help grassland owners diversify their income. Sustainable management can qualify them to tap into the growing market for sustainably-produced products (Kennard 2005). Maintaining healthy fish, wildlife, and wildflower populations improves prospects for landowners seeking to generate income through hunting, fishing, and ecotourism (Esseks and Drozd 2002, Tate 2003), which can greatly exceed income generated through agriculture and ranching (Balmford et al. 2002). It also makes them eligible for incentives that reward good stewardship (McQueen and McMahon 2003).

Concerning development pressures, there is a prevailing thought that as California grows it is inevitable that more homes must be built. While this is true, County agencies and developers which use subdivision for conservation purposes allow for a higher degree of efficiency in development, minimizing potential for destruction of open tracts of grassland. This holds particularly when alternative scenarios involve large parcel creation. Conservation easement language can also reflect this, specifying that the land be subdivided within a boundary, easing development rights for the remainder of the tract.

Financial Incentives for Grassland Conservation

Numerous incentives are offered by federal, state, local and private organizations to provide grassland owners, local governments, and NGOs with financial and technical assistance for implementing conservation measures (Appendix 5), as briefly summarized below.

Tax Incentives

Tax incentive programs help landowners reduce state and federal income and other taxes with a credit for part or all of the costs of conservation practices (Appendix 5). Perhaps the most common type of program is the conservation easement, which is designed on a case-by-case basis and can provide income, property, and estate tax credits (McQueen and McMahon 2003). Easements reward landowners for conserving grasslands for agricultural and open space purposes by assessing lands at a reduced tax rate that is based on the parcel's agricultural or open space value instead of its higher development value. McLaughlin (2004) estimated federal income tax savings for donating a conservation easement worth $500,000 to be $157,500 for a high-income ($250,000/year) landowner, $36,450 for a middle income ($75,000/year) landowner, and $9,450 for a low-income ($35,000/year) landowner.

Direct Funding

Opportunities include federal, state, local and private grants, purchases of conservation easements, cost sharing, and reimbursement of conservation-related expenses (Appendix 5). Federal programs offered by the Natural Resource

Conservation Service (NRCS) through the Farm Bill, for example, provide funding and cost-share opportunities to improve water management and quality, erosion control, wildlife habitat protection, and overall quality of land management by incorporating conservation into ranching and farming operations.

Technical Assistance

Landowners often need assistance with identifying and understanding relevant programs, understanding regulations, applying for permits or programs, or developing conservation, restoration, monitoring, and sustainable management plans. This type of advice is available through personal consultations, extension short courses, and other government and non-government sources (Appendix 5).

Regulatory Streamlining

Incentives include permitting landowners to conduct otherwise restricted activities, such as hunting and fishing, in exchange for implementing a management plan accepted by a federal or state conservation agency (Appendix 5). Examples of such programs include Safe Harbor Agreements (Bean et al. 2001) aimed at granting landowners more flexibility in promoting and protecting endangered species.

Ecosystem Services Incentives

An emerging category of incentives revolves around the stewardship of ecosystem services, whose economic value is often comparable to or even greater than the value of goods and services that have a market value, such as production of meat and crops (Daily 1997, Balmford et al. 2002). Ecosystem services provided by grasslands include pollination of crops by insects, soil fertility and stabilization, water

filtration and storage, livestock forage, species diversity, carbon storage, and genetic material for improving our food crops (Daily et al. 1997, White et al. 2000). Sala and Paruelo (1997) noted that not recognizing these services has resulted in management systems aimed at maximizing production of marketable goods and services such as meat. As Balmford et al. (2002) noted, the development of market instruments that capture the social values of relatively undisturbed ecosystems—for instance through carbon or biodiversity credits or through premium pricing for sustainably produced products—is a crucial step toward sustainability.

Educating grassland managers about the benefits of incentives

In a recent survey of agricultural landowners in California, 45 percent of respondents were not making an effort to minimize overgrazing, 55 percent were not making an effort to minimize soil erosion, and two thirds or more were failing to make an effort to protect or improve wildlife habitats (66%), minimize flow of chemical fertilizers or pesticides into surface or ground waters (69%), protect or improve flow of livestock wastes into surface ground water (75%), or protect or improve wetlands (83%) (Esseks and Drozd 2002). In many cases, this reflects that landowners remain unaware of the conservation options available to them (Bean et al. 2001).

Unfortunately, awareness of incentives is sufficiently low that programs are sometimes de-funded due to lack of use (Dawn Afman, U.S. NRCS, Pers. Comm.). This suggests that government agencies and NGOs need to develop better strategies to increase public awareness of and support for them (Jacobsen 2003, Farrior 2005).

Such strategies will have to appeal to personal concerns and values such as financial health, independence, and ingenuity by framing conservation actions as opportunities (as opposed to threats) to boost profits and solve time-consuming management problems (e.g., Farrior 2005). Schultz and Zelezney (2003) noted that when targeting the voting public in California as part of a campaign to protect open space, "our children's future" and quality of life (for our family and future generations) were foremost among reasons people cared about protecting land. Educational messages and materials can be made available through such channels as direct mailings, the internet, information booths at farmers' markets, extension short courses, and presentations at meetings of ranching, farming, and outdoor recreation organizations (Richards and George 1996, Jacobsen 2003, Tate 2003).

5. Concluding remarks

A large number of policies currently operate to influence the future of privately-owned grasslands in California, ranging from relatively strong regulations such as ESA and CESA to weaker but potentially influential guiding policies in County general plans to non-regulatory financial incentives such as tax breaks and financial assistance programs. The association of grasslands with wide ranging endangered species like the California condor and San Joaquin kit fox and locally important species like the Stephens kangaroo rat and Bay checkerspot butterfly has led to the establishment of large grassland reserves in many areas of the state undergoing large-scale development, with the trend being towards larger, sub-county

or county-wide biological conservation programs. Clearly that ESA and CESA are the major drivers of grassland protection in urbanized and urbanizing areas of California.

In more rural areas, the majority of grasslands are presently under agricultural and open space zoning and a large fraction is managed under Williamson Act contracts. Nevertheless, the future of these grasslands is tenuous, as continued rapid population growth and demand for rural residential development raise the market value of these lands. Counties have authority to protect habitat types that they consider important, but absent legally protected species or community types, few counties currently attribute special significance or conservation value to grassland ecosystems. Comparing the projected location of future development with the current distribution of grassland associated threatened and endangered species reveals areas, particularly central and southern California, where grasslands are likely to be heavily impacted (Figure 3). Counties where rapid growth and sensitive species distributions overlap will be the focus of intense planning efforts but also present an opportunity for implementation of more proactive grassland conservation policies.

The future of California grasslands also depends in part on public policies that tend to operate against grassland conservation. We have not analyzed such policies here but should at least mention that subsidies for agriculture, livestock grazing, water use, and road building and maintenance can promote cropping in marginal areas better suited for rangeland, overgrazing, and subdivision of rural lands (Myers and Kent 1998, Dale et al. 2000, U.S. General Accounting Office [GAO] 2005). Public policies pertaining to road network development and maintenance have a pervasive

influence, as roads serve as corridors for the spread of invasive species, fragment grassland habitats and degrade roadside environments (Forman et al. 2003, Gelbard and Belnap 2003, Gelbard and Harrison 2003).

Financial incentives are playing an increasingly important role in the protection and management of privately owned grasslands. Public agencies and conservancies such as The Nature Conservancy, the Trust for Public Land, the California Rangeland Trust, and dozens of county and local land trusts have already invested hundreds of millions of public and private dollars to protect grasslands through outright acquisition and conservation easements. Other kinds of incentives can also help improve the effectiveness of conservation partnerships. For example, The Malpais Borderlands Group, a coalition of ranchers, agencies, The Nature Conservancy, and foundations in southern New Mexico and Arizona, U.S.A., developed a grass banking approach to protecting and restoring grasslands (Page 1997). By joining the group, ranchers whose lands have become degraded gain access to a grass bank on which to graze their livestock (the 150,000 ha Gray Ranch), providing rest from grazing that allows their grasses to recover. They can also receive native reseeding, technical assistance, and monitoring from management experts. In exchange, they take steps such as (1) donating a conservation easement to protect their land as open space (which reduces their taxes); and (2) allowing natural fires to burn, which helps beat back invasive plants and stimulates the recovery of native grasses. Perhaps such an approach to landscape-scale grassland conservation could be tailored for use in California. For example, grass banking could give

ranchers a place to graze during years that their land is treated with fire and reseeding to eradicate weeds and restore native species (Corbin et al. 2004).

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Appendices

Appendix 1: Listed Threatened and Endangered Grassland Associated Species.

Threatened and Endangered Plants and Animals of California Grasslands

Scientific Name	Common Name	Status	
Plants		**State**	**Federal**
Acanthomintha duttonii	San Mateo thorn-mint	SE	FE
Acanthomintha ilicifolia	San Diego thorn-mint	SE	FT
Allium munzii	Munz's onion	ST	FE
Amsinckia grandiflora	Large-flowered fiddleneck	SE	FE
Arctostaphylos hookeri ssp. hearstiorum	Hearst's manzanita	SE	
Arctostaphylos hookeri ssp. ravenii	Presidio manzanita	SE	FE
Astragalus brauntonii	Braunton's milk-vetch		FE
Astragalus clarianus	Clara Hunt's milk-vetch	ST	FE
Blennosperma bakeri	Baker's blennosperma	SE	FE
Brodiaea coronaria ssp. rosea	Indian Valley brodoaea	SE	
Brodiaea filifolia	Thread-leaved brodiaea	SE	FT
Brodiaea insignis	Kaweah brodiaea	SE	
Brodiaea pallida	Chinesescamp brodiaea	SE	FT
Calochortus tiburonensis	Tiburon Mariposa lily	ST	FE
Castilleja affinis ssp. neglecta	Tiburon Indian paintbrush	ST	FE
Caulanthus californicus	California jewelflower	SE	FE
Ceanothus ferrisae	Coyote ceanothus		FE
Chlorogalum purpureum var. purpureum	Purple amole		FT
Chorizanthe howellii	Howell's spineflower	ST	FE
Chorizanthe robusta	Robust spineflower		FE
Chorizanthe valida	Sonoma spineflower	SE	FE
Cirsium ciliolatum	Ashland thistle	SE	
Cirsium fontinale var. fontinale	Fountain thistle	SE	FE
Clarkia franciscana	Presidio clarkia	SE	FE
Clarkia imbricata	Vine Hill clarkia	SE	FE
Clarkia speciosa ssp. immaculata	Pismo clarkia		FE
Clarkia springvillensis	Springville clarkia	SE	FT
Cordylanthus palmatus	Palmate-bracted bird's-beak	SE	FE
Delphinium luteum	Yellow larkspur		FE
Dudleya abramsii ssp. parva	Conejo dudleya		FT
Dudleya setchellii	Santa Clara Valley dudleya		FE
Dudleya stolonifera	Laguna Beach dudleya	ST	FT
Eriastrum hooveri	Hoover's woollystar		FT
Eryngium aristulatum var. parishii	San Diego button-celery	SE	FE
Fritillaria roderickii	Roderick's fritillary	SE	
Fritillaria striata	Striped abobe lily	ST	
Hemizonia conjugens	Otay tarplant	SE	FT
Hemizonia increscens ssp. villosa	Gaviota tarplant	SE	FE
Hesperolinon congestum	Marin dwarf flax	ST	FT
Hesperolinon didymocarpum	Lake County dwarf-flax	SE	
Holocarpha macradenia	Santa Cruz tarplant	SE	FT
Lasthenia conjugens	Contra Costa goldfields		FE
Lembertia congdonii	San Joaquin woollythread		FE
Lilium occidentale	Western lilly	SE	FE
Limnanthes douglasii ssp. sulphurea	Douglas' meadowfoam	SE	
Limnanthes floccosa ssp. californica	Butte County meadowfoam	SE	FE
Lupinus milo-bakeri	Milo Baker's lupine	ST	
Opuntia basilaris var. treleasei	Bakersfield cactus	SE	FE
Parvisedum leiocarpum	Lake County stonecrop	SE	FE
Pentachaeta bellidiflora	White-rayed pentachaeta	SE	FE
Pentachaeta lyonii	Lyon's pentachaeta	SE	FE
Plagiobothrys diffusus	San Francisco popcorn-flower	SE	
Plagiobothrys strictus	Calistoga popcorn-flower	ST	FE
Pseudobahia bahiifolia	Hartweg's golden sunburst	SE	FE
Pseudobahia peirsonii	San Joaquin adobe sunburst	SE	FT
Sidalcea keckii	Keck's checkerbloom		FE
Streptanthus albidus ssp. albidus	Metcalf Canyon jewel-flower		FE
Streptanthus niger	Tiburon jewel-flower	SE	FE
Thlaspi californicum	Kneeland prairie pennycress		FE
Trifolium amoenum	Showy Indian clover		FE
Verbena californica	California vervain	ST	FT

Scientific Name	Common Name	Status	
Vertebrates		**State**	**Federal**
Ambystoma californiense	California tiger salamander		FE
Ammospermophilus nelsoni	San joaquin antelope squirrel	ST	
Buteo Swainsoni	Swainson's hawk	ST	
Dipodomys ingens	Giant kangaroo rat	SE	FE
Dipodomys nitratoides exilis	Fresno kangaroo rat	SE	FE
Dipodomys stephensi	Stephens' kangaroo rat	ST	FE
Falco peregrinus anatum	Peregrine falcon	SE	
Gambelia sila	Blunt-nosed leopard lizard	SE	FE
Grus canadensis tabida	Sandhill crane	ST	
Gymnogyps californianus	California condor	SE	FE
Rana aurora draytonii	California red-legged frog		FT
Reithrodontomys raviventris	Salt-marsh harvest mouse	SE	FE
Riparia riparia	Bank swallow	ST	
Sylvilagus bachmani riparius	Riparian brush rabbit	SE	FE
Vulpes macrotis mutica	San Joaquin kit fox	ST	FE
Invertebrates		**State**	**Federal**
Branchinecta conservatio	Conservancy fairy shrimp		FE
Branchinecta longiantenna	Longhorn fairy shrimp		FE
Branchinecta sandiegoensis	San Diego fairy shrimp		FT
Branchinecta lynchi	Vernal pool fairy shrimp		FT
Cicindela ohlone	Ohlone tiger beetle		FE
Elphrus viridis	Delta green ground beetle		FT
Euphilotes enoptes smithi	Smith's blue butterfly		FE
Euphydryas editha bayensis	Bay checkerspot butterfly		FT
Euphydryas editha quino	Quino checkerspot		FE
Icaricia icarioides missionensis	Mission blue butterfly		FE
Lepidurus packardi	Vernal pool tadpole shrimp		FE
Speyeria callippe callippe	Callippe silverspot butterfly		FE
Speyeria zerene behrensii	Behren's silverspot butterfly		FE
Streptocephalus woottoni	Riverside fairy shrimp		FE

Legend:

FE: Federally listed as Endangered
FT: Federally listed as Threatened
SE: State listed as Endangered
ST: State listed as Threatened

Plant Selection

State and Federal threatened and endangered grassland associated species were selected from the Calflora database. Plants from communities m24 or m25 (Coastal Prairie or Valley Grassland) were selected. From this list, T + E sp. were selected. The regioncode was used to populate a list of T + E sp. by county. State "rare" species were excluded.

Animal Selection

State and Federal threatened and endangered grassland associated species were selected from the Wildlife Habitat Relationship database from the CDFG.

Invertebrate Selection:

Federal list of California invertebrates was compared with life history records to determine association with grassland ecosystems.

Appendix 2: Counties Surveyed and Grassland Areas

County	Acres	Proportion of Total Grassland Area	Cumulative Proportion of Total Grassland Area
Kern	1,343,693	12	12
San Luis Obispo	991,126	9	21
Monterey	638,047	6	27
Fresno	529,088	5	32
Tehama	499,305	5	37
Merced	497,017	5	41
San Benito	443,567	4	45
Tulare	340,365	3	49
Stanislaus	319,211	3	52
Santa Barbara	282,500	3	54
Mendocino	277,068	3	57
Madera	263,414	2	59
Sonoma	227,310	2	61
Humboldt	221,038	2	63
Glenn	215,657	2	65
Kings	209,388	2	67
Sacramento	201,053	2	69
Siskiyou	187,571	2	71
San Joaquin	169,555	2	73
Mariposa	165,737	2	74
San Diego	163,106	2	76

Appendix 3: General Plan policy table

Rank	County	Year	Land Use	Conservation	Open Space	Agriculture	Coastal	Scenic Highways	Resource Conservation
1	Kern	2004		0*		DNE	DNE	DNE	DNE
2	San Luis Obispo	1974-1998	1,2	NA	1,3	1,3	NA	DNE	DNE
4	Fresno	2000	0	3*		DNE	DNE	NA	NA
6	Merced	1990-2002	1	1*		1,2	DNE	DNE	DNE
7	San Benito	1980-1998	0	NA	2	DNE	DNE	NA	DNE
8	Tulare[1]	1972-1981	0	1*		DNE	DNE	0	DNE
9	Stanislaus	1992-1994	0	3*		1	DNE	DNE	DNE
10	Santa Barbara	1975-2004	0	1,3	1	0	3	NA	0
11	Mendocino	1981	1	2*		DNE	1	1	DNE
12	Madera	1995	0	1,2	2	DNE	DNE	NA	NA
13	Sonoma	1989	0	1	3	0	DNE	DNE	DNE
14	Humboldt	1982-1984	0	0	0	0	0	DNE	1
16	Kings	1996-2004	0	2	0	DNE	DNE	DNE	DNE
17	Sacramento	1974-1993	0	3	1	0	DNE	NA	DNE
20	Mariposa	2003	1	1*		1	DNE	0	0
21	San Diego	2000	2	3	0	DNE	NA	1	DNE

Recognize grassland ecosystems[+]

Recognize native ecosystems[+]

Recognize native grassland ecosystems[+]

0 = no recognition of grasslands or native ecosystems, 1 = specific recognition of grassland ecosystems, 2 = specific recognition of native ecosystems, 3 = specific recognition of native grasslands, NA = element not readily available for this county, DNE = element oes not exist

*Several counties combine mandatory elements. For these counties the colums have been merged.

[+]Drawn from current and available county general plans (16 total, excluding Monterey, Tehama, Glenn, Siskiyou, and San Joaquin).

[1]The land use element for Tulare County was unavailable. This information is from a 1991 general plan policy *summary of policies from 1964 to 1998.*

Grassland Ownership and Management By County

	Public Reserve		Public Non Reserve		Private Reserve		Private Non Reserve		Total
County	**Acres**	**% of County**	**Acres**	**% of County**	**Acres**	**% of County**	**Acres**	**% of County**	**Acres**
Kern	36,158	1	137,511	3	5,056	0	1,164,968	22	1,343,693
San Luis Obispo	24,354	1	163,014	8	1,127	0	802,630	38	991,126
Monterey	5,458	0	72,477	3	726	0	559,385	26	638,047
Fresno	25,234	1	76,569	2	3,138	0	424,147	11	529,088
Tehama	24,824	1	19,118	1	20,887	1	434,476	23	499,305
Merced	38,044	3	5,347	0	7,116	1	446,510	35	497,017
San Benito	6,299	1	34,520	4	346	0	402,402	45	443,567
Tulare	17,381	1	9,422	0	2,488	0	311,074	10	340,365
Stanislaus	2,735	0	205	0	1,688	0	314,583	32	319,211
Santa Barbara	3,773	0	30,144	2	1,685	0	246,897	15	282,500
Mendocino	3,595	0	11,977	1	64	0	261,432	12	277,068
Madera	2,619	0	7,082	1	509	0	253,203	18	263,414
Sonoma	6,657	1	8,179	1	1,384	0	211,090	21	227,310
Humboldt	7,443	0	6,227	0	30	0	207,339	9	221,038
Glenn	4,055	0	5,935	1	539	0	205,128	24	215,657
Kings	0	0	7,289	1	0	0	202,098	23	209,388
Sacramento	2,703	0	4,596	1	4,977	1	188,777	30	201,053
Siskiyou	6,580	0	16,141	0	620	0	164,230	4	187,571
San Joaquin	1,122	0	237	0	3,902	0	164,294	18	169,555
Mariposa	2,199	0	7,929	1	0	0	155,609	17	165,737
San Diego	3,348	0	54,861	2	7	0	104,889	4	163,106
Solano	3,630	1	3,484	1	1,567	0	148,673	26	157,353
Contra Costa	6,889	1	11,018	2	15,520	3	121,544	24	154,971
Alameda	4,094	1	2,422	0	15,674	3	132,512	25	154,702
Santa Clara	3,393	0	6,200	1	600	0	140,812	17	151,005
Calaveras	59	0	5,159	1	4,379	1	135,295	20	144,892
Riverside	8,238	0	16,042	0	3,244	0	112,038	2	139,562
Butte	8,616	1	1,376	0	1,053	0	127,709	12	138,754
Marin	27,090	7	5,407	1	988	0	85,852	23	119,337
Shasta	361	0	1,700	0	5	0	107,787	4	109,853
Colusa	4,092	1	1,703	0	1,181	0	102,870	14	109,846
Yolo	521	0	1,539	0	0	0	105,482	16	107,543
Tuolumne	4,174	0	12,760	1	0	0	86,159	6	103,093
Placer	489	0	1,228	0	0	0	99,606	10	101,323
Yuba	2,928	1	20,588	5	37	0	58,224	14	81,778
Amador	153	0	1,250	0	0	0	76,986	20	78,390
El Dorado	3,791	0	1,070	0	0	0	71,004	6	75,865
Los Angeles	4,225	0	3,272	0	32	0	59,586	2	67,115
Ventura	6,128	1	3,141	0	67	0	55,528	5	64,864
Napa	588	0	2,006	0	35	0	59,942	12	62,571
Lake	2,301	0	4,967	1	62	0	43,905	5	51,234
Trinity	2,676	0	4,416	0	15	0	36,529	2	43,635
San Bernardino	5,112	0	2,147	0	0	0	34,302	0	41,562
Plumas	598	0	19,323	1	35	0	20,939	1	40,895
Mono	12,113	1	22,306	1	0	0	4,957	0	39,375
Sutter	657	0	242	0	72	0	38,303	10	39,274
Lassen	1,856	0	14,164	0	35	0	19,694	1	35,748
Orange	2,424	0	1,836	0	432	0	28,819	6	33,512
Nevada	875	0	1,712	0	2	0	28,370	5	30,959
Modoc	1,050	0	11,500	0	2	0	14,060	1	26,613
San Mateo	655	0	991	0	2,538	1	18,967	5	23,151
Santa Cruz	1,665	1	57	0	22	0	12,249	4	13,993
Alpine	2,162	0	6,682	1	0	0	2,019	0	10,863
Sierra	430	0	4,114	1	5	0	3,810	1	8,359
Del Norte	420	0	919	0	72	0	2,656	0	4,067
San Francisco	10	0	42	0	0	0	185	0	237
Inyo	0	0	12	0	0	0	0	0	12
Imperial	0	0	0	0	0	0	0	0	0
Total	**349,046**		**875,577**		**103,962**		**9,422,536**		**10,751,121**
Percent of Total Grassland Area	**3.25**		**8.14**		**0.97**		**87.64**		**100.00**

Appendix 4. Ownership and management profile of California grassland. (FRAP data)

Appendix 5 is un-attached and can be found online at: http://www2.bren.ucsb.edu/~ca_grasslands/appendix5.htm

Appendix 5: Links to public and private incentive based conservation programs

Tables

Mechanism	Features	Extent	Example
Grassland species protected by both ESA and CESA Protection provided by both state and federal statutes	Prohibits take or destruction of critical habitat.	11 vertebrates, 30 plants	San Joaquin Kit Fox, Steven's Kangaroo Rat
Grassland species protected by ESA Protection provided only by federal statute	Prohibits indirect or direct "take" for listed speices. HCPs offer exemptions to this rule. Does not prohibit "take" of plants species on private ly owned land.	12 vertebrates, 14 invertebrates, 41 plants. 3.9 million acres in approved HCPs/NCCPS, 7.8 million acres in planned HCPs/NCCPs * We were unable to differentiate between HCP and NCCP acreage.	There are five grassland associated species listed under ESA and not CESA: San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*), California red-legged frog (*Rana aurora draytonii*), California Tiger Salamander (*Ambystoma californiense*), Riparian woodrat (*Neotoma fuscipes riparia*), Buena Vista Lake shrew (*Sorex ornatus relictus*)
Grassland species protected by CWA Protection provided only by federal statute	Section 404 restricts discharge of fill material into the "waters of the United States" without a permit.	All federal jurisdictional wetland and vernal pool habitat throughout California.	A 1000 acre complex of vernal pools at the University of California, Merced site . These vernal pools fall within federal jurisdiction due to swale connection to the San Joaquin River.
Grassland species protected by CESA Protection provided only by state statute	Prohibits indirect or direct "take" for listed speices. NCCPs offer exemptions to this rule.	17 vertebrates, 34 plants	There are four grassland associated species listed under CESA and not ESA: San Joaquin antelope squirrel (*Ammospermophilus nelsoni*), Swainson's Hawk(*Buteo swainsoni*), Bank Swallow (*Riparia riparia*), and Belding's savannah sparrow (*Passerculus sandwichensis beldingi*).
CEQA Requires mitigation for projects that negatively affect the environment.	Evaluated on a case-by-case basis; not preventative.	Unknown	A building project at the University of California, San Diego was required to mitigate for impacts to native grassland habitat.
Easements Usually for open space or agricultural preservation. Sometimes explicitly for grassland habitat incl. native perennials.	Incompatible land use in easement areas can decrease the conservation value of these areas.	Unknown, though assumed small	The Nature Conservancy has at least two projects that protect grasslands, the Mount Hamilton Project east of San Jose and the Merced Grassland conserving 81,000 and 5,000 acres respectively.
Williamson Act Subset of agriculturally zoned areas. Land required to remain in agricultural for ten-year contracts, preventing development for a limited time.	Conservation value compromised by intensive land uses.	Covers roughly 9.9 million acres of nonprime farmland as of 2003. Within counties with available saptial data, an average of 60% of all grasslands were in non-prime contracts from 2000-2004 .	Humboldt County adopted Williamson Act guidelines in 1969 and issued a guideline update in 2002. Most of the grazing lands in the county are enrolled in the program.
Agricultural zoning Lower density zoning that can constrain the extent of development.	Incompatible land uses can limit conservation value. Desire to preserve prime farmland can funnel development to non-prime rangeland/grassland.	Affects the largest area of grassland with 50% zoned statewide (varies by county).	Humboldt County general plan Policy 2523 in the general plan states that agricultural lands "shall be preserved" and lists several actions to fulfill this policy. However, policy 2523 1.D. directs development to "uneconomical or marginally viable agricultural lands" when development must occur.
Open space zoning Lower density zoning that can constrain the extent of development.	Provides weak controls on development. A small amount of this land is strongly protected (conservation easements, etc.). This designation allows incompatible land uses such as motorized sports, golf courses, etc.	Affects the second-largest area of grassland with 20% zoned statewide (varies by county).	Fresno County OS D.5 states "The County shall strive to identify and conserve upland habitat areas adjacent to wetland and riparian areas that are critical to the feeding, hibernation or nesting of wildlife species associated with these wetland and riparian areas."

Table 1. Listing of federal, state and county policies/regulations that affect grasslands and grassland associated species.

Ownership Type	Grassland Area (acres)	Percent of Total Grasslands in California
Private	9,462,200	88.08%
Federal	759,427	7.07%
Military	227,305	2.12%
State	131,517	1.22%
Other	162,819	1.52%

Table 2. Area of Federal and State owned lands by grassland type. GIS analysis done using layers from FRAP website and GAP analysis.

County	Number of HCPs/NCCPs	Area Covered (acres)	Number of Planned HCPs/NCCPs	Area Planned (acres)
Multiple Locations*	1	2,937	0	0
Alameda	1	32.3	0	0
Contra Costa	0	0	1	175,435
Fresno	2	104.12	1	10
Kern	8	286,790.5	1	1,900,000
Kern/Tulare/ Kings	1	19,900	0	0
Los Angeles	1	14	1	8,661
Merced	0	0	2	250,630
Monterey	1	11.5	0	0
Orange	1	208,000	1	91,000
Placer	0	0	1	273,983
Riverside	10	1,853,644.5	1	11,785
Sacramento	0	0	1	340,000
Sacramento/ Sutter	1	53,342	0	0
San Benito	0	0	1	888,960 (County-wide Plan)
San Diego	5	608,938.9	3	1,585,938
San Joaquin	2	896,300	0	0
San Mateo	2	3,525.4	0	0
Santa Clara	2	5.02	1	440,318
Santa Cruz	3	168.7	0	0.0
Shasta	0	0	1	160,000
Solano	0	0	1	530,560 (County-wide Plan)
Tulare	1	9.7 Linear Miles	0	0
Yolo	0	0	1	400,000
Yuba/Sutter	0	0	1	200,100
Total**	42	3,933,713.94	19	7,257,380.0

*This plan covers 25 existing and 4 planned sites in California

** Total Area Covered does not include the Tulare County plan. Some planning areas overlap, so these numbers may be overestimates. Planning areas include both reserve and non-reserve areas covered by these plans.

Table 3. HCPs and NCCPs affecting grassland species

These HCPs and NCCPs exclude constructed wetlands because we assumed that they would not contain grassland habitat. Data for this table from http://ecos.fws.gov/conserv_plans/servlet/gov.doi.hcp.servlets.PlanReportSelect?region=8&type=HCP and http://www.dfg.ca.gov/nccp/status.htm. For plans listed by both the FWS and DFG, FWS area numbers were used. For plans containing multiple subarea plans, all subareas plans were considered to be on HCP/NCCP

Zoning	Grassland Area (acres)	Percent
Agriculture	7,831,093	53.25%
Open Space	2,991,640	20.34%
Very Low Density Residential	1,888,981	12.84%
Low Density Residential	1,316,524	8.95%
Other	14,467,465	4.62%

Table 4. Area of grassland in general plan zones.

County	Annual Grasslands in Wiliamson Act (acres)	Percent Annual Grassland in Williamson Act
Glenn	215,671	99.9%
San Benito	345,930	77.9%
Tehama	371,992	74.5%
Madera	192,720	72.6%
Santa Barbara	181,845	64.4%
Fresno	287,035	54.3%
Humboldt	90,302	40.9%
Sacramento	64,954	32.3%

Table 5. Grassland area currently under Williamson Act contracts.

Figures

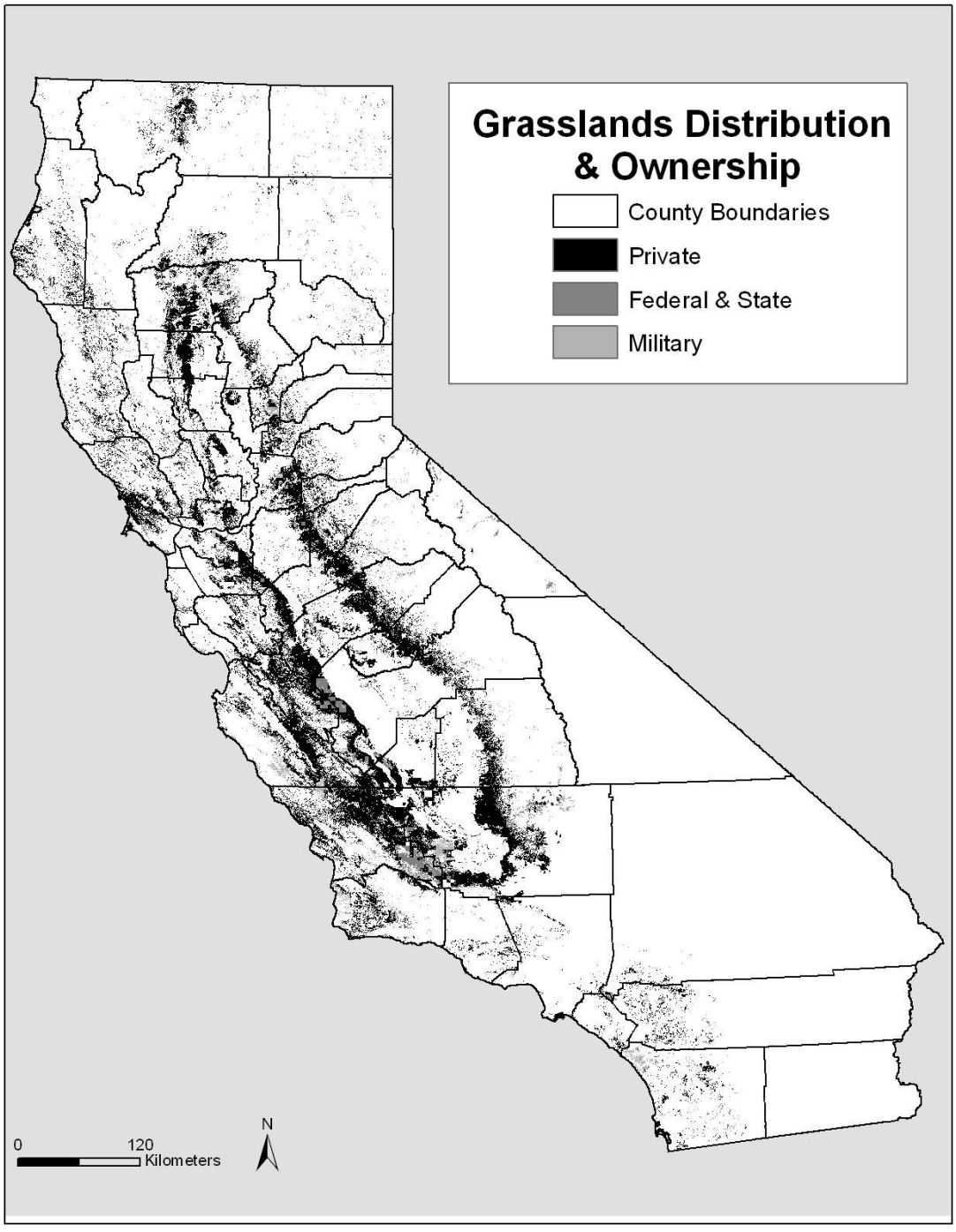

Figure 1. Grassland distribution in California.

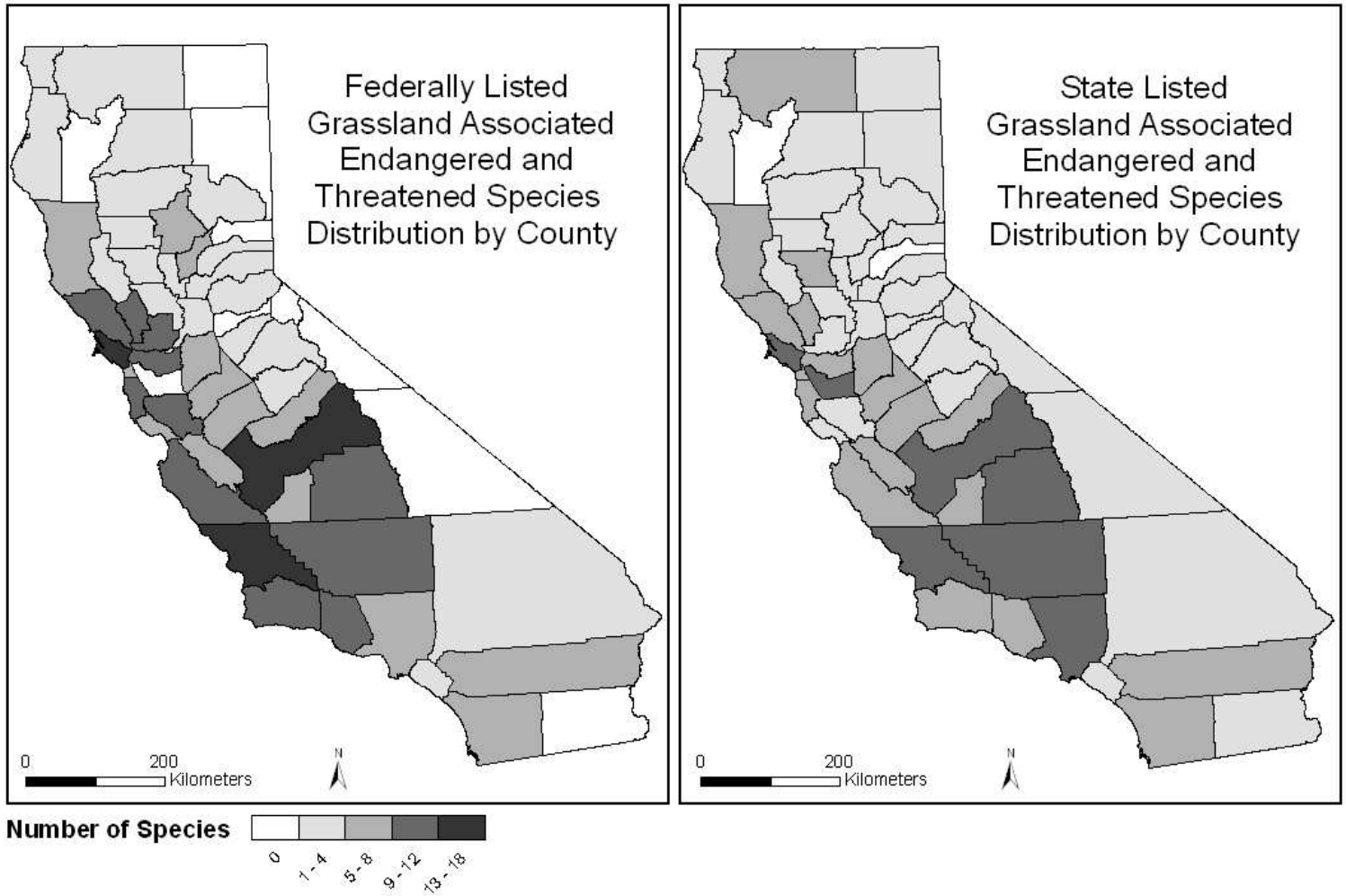

Figure 2. Number of federal (a) and state (b) listed endangered or threatened grassland associated species by county.

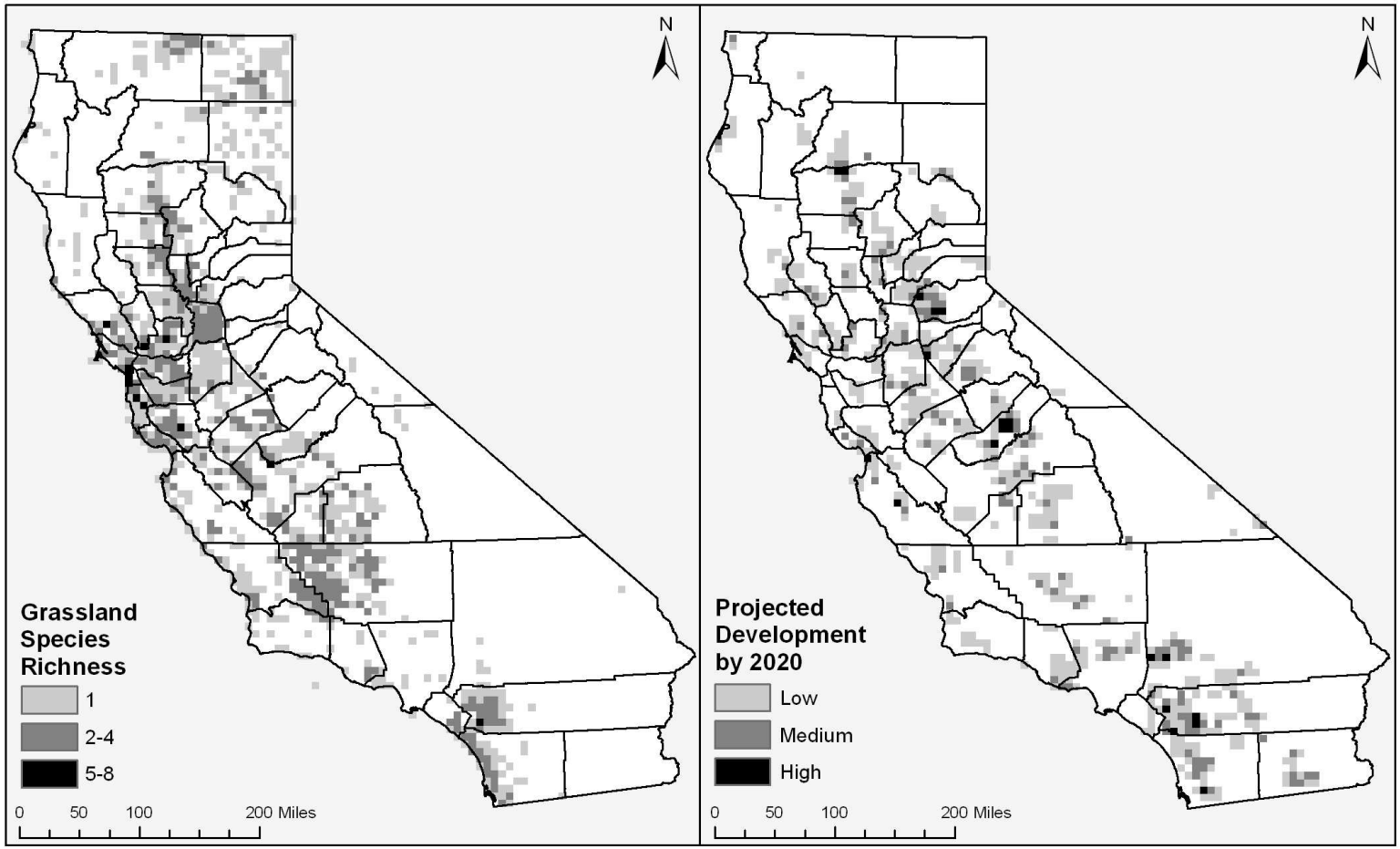

Figure 3. Comparison of threatened and endangered grassland species distributions with projected development in California. The threatened and endangered species map was derived from California Natural Diversity Database point data

and was generalized to 10 kilometer grid cells. Projected development was derived from FRAP data. The original FRAP data combined historical growth patterns with population projections to forecast growth for 5 kilometer grid cells. For each 10 kilometer grid cell in our map, we calculated the area of underlying 5 kilometer cells projected to reach a density of 1 house per 20 acres by the year 2020.