

# Chapter 16

## Summary: The Past, Present, and Future of California Chaparral



**Hugh D. Safford, Emma C. Underwood, Nicole A. Molinari,  
and Jon E. Keeley**

Chaparral ecosystems have covered expansive swaths of low- and mid-elevation California for millions of years. Like the world's four other Mediterranean-type climate (MTC) regions, the California landscape is biologically diverse, with plentiful resources. Consequently, when human immigrants arrived from Asia in the late Pleistocene they found ample sustenance to support their needs and in turn, learned to manage these ecosystems and leave their own mark on the landscape (see Chaps. 1–3). By the time of the arrival of Europeans in California in the late eighteenth century, Native American populations near the coast were perhaps the largest of any indigenous peoples in North America. Native American management of chaparral habitats was extensive and locally intensive, and the variegated landscape that Spanish explorers and missionaries encountered near the coast and at lower elevations was largely the product of indigenous management, with fire being the central management tool (see Chap. 4).

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H. D. Safford  
USDA Forest Service, Pacific Southwest Region, Vallejo, CA, USA  
University of California, Davis, CA, USA

E. C. Underwood  
University of California, Davis, CA, USA  
University of Southampton, UK

N. A. Molinari  
USDA Forest Service, Los Padres National Forest, Goleta, CA, USA

J. E. Keeley  
U.S. Geological Survey, Three Rivers, CA, USA  
University of California, Los Angeles, CA, USA

Euro-American settlement in California brought a new set of cultural norms and management practices. Fire was feared, indigenous peoples were erased, and settlement and large scale resource extraction became the economic driving forces (see Chap. 12). Because chaparral did not provide many commodities necessary to support Euro-American populations, it was viewed as an impediment, and its reduction or removal an imperative. Ironically, maltreatment of the mountainsides and watersheds surrounding southern California settlements led ultimately to the establishment of some of the first federal public lands in the West, as it was clear to these early land stewards the important role chaparral played in protecting watersheds (see Chaps. 6 and 7). However, competing with these values was an ever-growing belief that chaparral landscapes could better provide other services, such as grazing, timber, or housing (see Chaps. 5, 11, and 15).

The paucity of lightning ignitions along the California coast led to long fire-free periods before humans arrived, however over the last 12,000 years human ignitions have dominated the chaparral fire regime, and as human populations have increased, so have ignitions. Today millions of Californians live embedded in landscapes that were, or are still, dominated by chaparral and other related shrubland types, and the number of annual fire ignitions is far higher than the historical range of variation. The dense nature of chaparral fuels leads inevitably to high intensity crown fires that spread rapidly across the landscape, posing a serious threat to human populations that have chosen to live within these watersheds. Unlike many western forests where fire suppression has altered natural fire regimes, in California chaparral fire suppression is necessary to offset the huge increase in anthropogenic ignitions. This need is so critical that it has resulted in an inordinate focus of management dollars on fire protection, with little time, money, or interest remaining to adequately grapple with the myriad other problems that afflict chaparral landscapes. These include non-native plants and animals, air pollution and atmospheric nutrient inputs, threatened and endangered species, erosion and sedimentation, debris flows and floods, climate change, heavy recreational use, suburban expansion, and so on (see Chaps. 6–9, 11, 12, 14, and 15).

However, there is an optimistic future for chaparral. Despite chaparral habitats being bulldozed, burned-off or degraded, people have finally begun to take notice. Once unimaginable, a chaparral conservation ethic is developing, and it is infusing decisions and opinions in government agencies, academia, environmental organizations, and the general public. In science, a measure of this is the exponential increase in Google Scholar-cited studies involving both “chaparral” and “conservation”, rising from 88 between 1951 and 1955, to 6510 between 2011 and 2015 (5-year increments from 1951 to 2015;  $y = (7E-65)e^{0.0777x}$ ;  $R^2 = 0.985$ ). In the management sphere it is reflected in changes in the US Forest Service Forest Plans between the original plans from the mid-1980s and the most recent 2001 edition, in an uptick in restoration projects in chaparral habitats, and in recent progressive fuel treatment planning processes occurring on both national park and national forest lands (see Chaps. 12 and 15). In the political realm, three large national monuments (San Gabriel Mountains, Sand to Snow, Berryessa-Snow Mountain; ranging in size from 62,000 ha to 140,000 ha (153,205 to 345,946 acres) have been created in chaparral dominated landscapes since 2014. In the public sphere, the evidence is in the rising number of chaparral-related

environmental education facilities and curricula (see Chap. 11), and in the number of recent symposia and workshops focusing on chaparral conservation and management issues, including the 2011 MEDECOS conference (the International Mediterranean Ecosystems Conference) at the University of California, Los Angeles, the 2013 and 2015 US Forest Service Southern California Chaparral Symposia, and the chaparral sessions at the 2016 Natural Areas Conference at the University of California, Davis.

This book builds on these efforts to amplify the public's understanding of the value of chaparral. Its pages are filled with rich descriptions and images of the intrinsic and intangible value of these landscapes, appreciated by Native people, early settlers, and present populations alike. As John Muir noted, chaparral is a "quickly available retreat"...where within a "few hours lowlanders can get well up into the sky and find refuge ... while breathing reviving ozone[sic], they may absorb the beauty about them" (Muir 1901). The book has also presented in depth a more formal description of "ecosystem services," one which articulates, quantifies, and values the stocks and flows of services and identifies specific beneficiaries. It exemplifies the range of ecosystem services provided by chaparral, from regulating services such as carbon storage (see Chap. 6), water provision and water quality (see Chap. 8), to provisioning services such as sediment erosion retention and flood mitigation (see Chap. 7), habitat and supporting services (see Chaps. 2 and 3), to cultural services such as recreation (see Chap. 10) which also encompasses chaparral's intrinsic value. An appreciation by society of both these formal ecosystem service values as well as the informal appreciation of chaparral's raw and natural beauty are needed in concert.

However, as is typically the case, the value of such services only becomes apparent as the services become scarce. If current trends continue, further diminishment in the supply of ecosystem services provided by chaparral seems inevitable. Future climate projections foresee temperatures rising another 2 °C to 5 °C by the end of the century (see Chap. 14), demographic projections suggest chaparral dominated counties in the San Francisco Bay Area and southern California may see human population increases of 20–50% by 2040 (CEF 2015), while high fire frequency and subsequent invasion of non-native annuals has the potential to change many of California's chaparral landscapes forever (see Chap. 12). These trends do not bode well for the sustainability of chaparral habitats and the services they provide.

In drawing this book to a close, we would like to finish by highlighting some of the key issues and challenges currently facing chaparral landscapes and the people who manage and live in them:

- **Ecosystem services:** Unlike in forested ecosystems, the recognition that there are valuable ecosystem services associated with chaparral landscapes is a recent development. For example, California carbon storage assessments have mapped chaparral areas as blanks for years, but now we know that rates of carbon sequestration and sustained carbon storage in chaparral can compare to some forest types. The quantification, spatial mapping, and economic valuation of these services and incorporation of this information into project planning and prioritization activities can revolutionize how we manage chaparral (see Chap. 9 and Box 15.3).

- **Fire suppression:** Given the continued expansion of communities and infrastructure into wildland areas and the need to protect human lives and homes, funding for fire suppression will likely continue to dominate the budgets of public agencies tasked with managing chaparral landscapes. However, steps can be taken to reduce fire risks while minimizing damage to chaparral habitats, such as pre-emptive approaches focused on ignition reduction, savvy land use planning, and structure hardening. Implementing these ideas is achievable through collaborations between city and county governments, NGOs, land management agencies, local fire departments, fire safe councils, and business and homeowner groups. In addition, strategically placed and maintained fuelbreaks will continue to aid in fire suppression, but success will be maximized when fuelbreak treatments are coupled with community preparedness that reduces structure vulnerabilities.
- **Land use planning:** For many decades, land use planning decisions have been made by cities and counties in chaparral landscapes with little consideration of the impacts on human safety and fire protection, logistics, and cost, or the reciprocal impacts on chaparral landscapes from the increased ignitions that derive from housing subdivisions. The bloated fire management budgets, and dwindling resource and recreation budgets, in the southern California public land management agencies are due directly to choices made in planning, development, and zoning departments across the region. An average year sees hundreds to thousands of homes lost to fire, human fatalities and injuries, and millions to billions of dollars in economic losses. Development pressures, and potential profits, are huge in many chaparral landscapes. Perhaps an enhanced understanding of the issues and values at risk can lead to a more reasonable balance between economic growth, human safety, and environmental protection. We hope our book will inform the debate.
- **Restoration:** Chaparral was once thought to be a resilient and stable vegetation type on the landscape, however with repeat disturbance, drought-induced dieback, and large scale type-conversion, there is a nascent movement to restore areas of degraded chaparral. Although there is much to be learned about how to accomplish chaparral restoration across broad scales, small scale projects indicate that topsoil preservation, the use of container stock, and non-native species suppression are fundamental to success, as is protection of the site from excessive fire. Land managers can also draw from assessments of ecosystem services to guide restoration priorities and focus efforts on sites where re-establishing chaparral aligns with the long-term provision of high value ecosystem services (see Box 15.3).
- **Old-growth chaparral:** Chaparral communities over 75 years old are top priorities for protection, not only because of the remarkable biodiversity they support and the ecosystem services they provide, but also because of impending threats from urban development, fragmentation, increased fire frequencies, invasive non-native plants, and warming temperatures. The fact is that very few areas remain in southern California chaparral that have escaped fire for three-quarters of a century. Such areas are ecologically unique, and they are highly threatened by all of the trends that we have highlighted throughout this book. We believe that the preservation of old-growth chaparral for its own sake should be a priority for management agencies.

- **Future climates and human demography:** Projected changes in the climate and human population will challenge the long-term integrity of chaparral landscapes. Temperature and precipitation directly influence the structure and function of chaparral communities as well as disturbances like fire that impact them. Increased densities of humans and their infrastructure will also heat the air, use more water, and ignite more fires. Where chaparral will continue to grow in 100 years is challenging to predict, as it depends on interactions between the climate, fire, and human actions. Predictions are that human populations in chaparral areas will grow by up to 50% by the middle of the century, and we are confident that the climate will be warmer. But we do not know how much warmer, and we do not know whether the warmth will be accompanied by more or less precipitation. Most published future climate studies project drier summers and more drought, but recent modeling is suggesting the possibility of wetter conditions under some scenarios. With such divergent futures possible, it seems important for the resource management agencies to undertake scenario planning. This sort of effort is underway, or is in development, in at least some agencies. For example, a climate change vulnerability and adaptation assessment was recently completed for the southern California national forests (see Box 15.1).
- **Relieving tension between conservation and recreation:** Chaparral landscapes are the natural backyard for tens-of-millions of urban residents in southern California, the San Francisco Bay Area, and elsewhere. At the same time, these landscapes support essential ecosystem services and hundreds of threatened, endangered, and sensitive species. Some areas in these landscapes are suffering from overuse, but other areas could realistically support more use. One of the chief challenges for management agencies in chaparral landscapes will be to find the proper balance between human use and conservation. Three recently named national monuments in chaparral dominated geographies (see Chap. 15) attest to the value that people place in these landscapes. The heightened profile that such designations provide will hopefully result in more public investment in modern, low-impact recreation infrastructure, enhanced enforcement, and perhaps most importantly, increased educational outreach.
- **Relieving tension between conservation and fuel management:** Another major challenge for public land management agencies is balancing conservation and fuel management priorities. Land management agencies have the unenviable task of protecting human communities that were typically built with nary a thought of the hazards posed by the surrounding environment. Some level of fuel reduction is clearly necessary, but the vegetation loss and diminishment of ecosystem services associated with such work is an important regulating factor. Looking forward, fuel management planners and the public need to acknowledge that the environmental risks of overly frequent burning in chaparral landscapes are real and significant, and that the success of fuel reduction is largely contingent on firefighter access and weather conditions. At the same time, the public needs to better understand that the real value of fuel treatment in chaparral landscapes is not usually realized in the here and now, but rather in long-term risk reduction, and broad scale protection of environmental values and ecosystem

services, usually in other, untreated areas. The major threat to both chaparral sustainability and human safety is overly frequent fire, and strategic fuel management is a necessary part of the response. In the not-too-distant future, fuel management planning (and other management actions) will benefit from the availability of spatial information on ecosystem services and how they are likely to be changed by potential management actions and disturbances. Cost-benefit assessments based on this kind of information should help to clear some of the smoke that clouds this issue currently.

It seems obvious to us that the optimal path for resolving these challenges and enhancing the conservation and sustainability of chaparral lies in uncovering and promoting the multiple benefits chaparral provides. Our book approaches the chaparral ecosystem from various angles—cultural, biological, historical, environmental, ecological, sociological, managerial—but a common theme to all of its chapters is the importance of considering the whole ecosystem and the different perspectives people hold of it. We firmly believe that an ecosystem service-based approach, coupled with a greater appreciation of its non-quantifiable components, can provide a broader and more practical understanding of the value of chaparral. In the end, we hope our book provides a common starting point for incorporating these varying perspectives of chaparral value into more robust, strategic, and creative solutions for protecting chaparral landscapes today and in the future.

## Reference

CEF (California Economic Forecast). 2015. California county-level economic forecast 2015–2040. California Department of Transportation, Sacramento, California, USA. <http://www.dot.ca.gov/hq/tpp/offices/eab/docs/Full%20Report%202015.pdf>.