

# Chapter 1: Introduction

Peter A. Stine and Patricia N. Manley<sup>1</sup>

The California spotted owl (*Strix occidentalis occidentalis*) occurs across a large portion of California, including the portion of the southern Cascade Range south of the Pit River that abuts the Sierra Nevada and throughout the Sierra Nevada, the mountains of central coastal California, and the Peninsular and Transverse Ranges of southern California. The future of the California spotted owl is of concern because of population trends over the past few decades, the potential impacts of forest management, and the threat of high-severity fire on its primary habitat of closed-canopy forest. Data from demographic studies conducted in three locations in the Sierra Nevada show that populations have been declining over the past 20-plus years (e.g., Conner et al. 2013, Tempel et al. 2014). The majority of the current range of the owl occurs on public lands, primarily national forests.

## Regulatory Context

The U.S. Forest Service (USFS) is required, under the new 2012 National Forest Management Act (NFMA 2012) Planning Rule (36 CFR 219; Federal Register 2012), to identify potential species of conservation concern and provide an assessment of existing information for those species. A species of conservation concern is defined as:

...a species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area.

The California spotted owl is considered a species of conservation concern (FS Handbook 1909.12 § 12.52c-d), thus the USFS is directed to identify and assess information relevant to this species. A technical assessment of its status and threats is a valuable, if not essential, step in informing effective conservation measures and strategies. Among other applications, the information presented in this assessment will inform revisions of the USFS Land and Resource Management Plans for the 15 national forests within its range.

---

<sup>1</sup> **Peter A. Stine** is a biogeographer and retired Director of Partnerships and Collaboration, U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, John Muir Institute for the Environment, 1 Shields Ave., University of California–Davis, CA 95616; **Patricia N. Manley** is a research program manager, U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Conservation of Biodiversity Program, 2480 Carson Rd., Placerville, CA 95667.

The first technical assessment for the California spotted owl “The California Spotted Owl: a Technical Assessment of Its Current Status” or (CASPO) was initiated in 1991 (Verner et al. 1992). It was developed to help guide management direction for national forest project planning in the Sierra Nevada and southern California mountains (Verner et al. 1992; see below for more details). The interim management guidelines recommended in CASPO were followed by the national forests in the Sierra Nevada until the Sierra Nevada Forest Plan Amendment record of decision (ROD) was released in 2001 and then amended in 2004. The ROD (USDA FS 2004) provided some specific standards and guidelines for California spotted owl habitat based on a science synthesis created for the forest plan amendment process. Additionally, the 2004 ROD focused on fuels treatments because loss of owls and their habitat as a result of catastrophic wildfires was considered a significant threat to the species. Much has been learned about the ecology of California spotted owls since CASPO, but there has been no comprehensive assessment of this new information. New information in the published literature needs to be assessed to improve our understanding of its significance and relevance to management and future research. Periodic syntheses and assessments also help bring cohesion to the interpretation of new information, thereby guiding its application to management. Over the 25-year period since CASPO, many site-specific research projects, long-term demographic monitoring, basic ecological research, and specific project monitoring activities have occurred throughout the range of the California spotted owl. Dozens of peer reviewed publications have resulted from these activities (e.g., see chapters 2, 3, 4, 7, and 8), and given forest plan revision activities and growing concerns for the status of the spotted owl, it was timely to generate an updated assessment to support and inform conservation and management efforts.

## **1992 California Spotted Owl Technical Assessment**

The information benchmark for our assessment was CASPO (Verner et al. 1992). The CASPO represents the last effort to comprehensively summarize what is known about this subspecies throughout its range. It was developed over a 1-year period by a technical team dedicated solely to this task. The CASPO was conducted in response to the designation of the northern spotted owl (*S. o. caurina*) in 1990 as a federally listed threatened species, the recognition that forest managers in California would benefit from an assessment of the current status of the California subspecies, and the need to develop a scientifically defensible plan for the conservation of the California spotted owl. The CASPO received direction from the California Spotted Owl Assessment Team Steering Committee, whose members represented

several state of California (Resources Agency, Board of Forestry, Department of Fish and Game, and Department of Forestry and Fire Protection) and federal entities (U.S. Department of Agriculture Forest Service; and U.S. Department of the Interior Bureau of Land Management, Fish and Wildlife Service, and National Park Service).

The charter for CASPO specified submission of a report to the steering committee on the current status of the California spotted owl following “accepted scientific standards and practices.” The 285-page CASPO report was intended to provide guidance for managing owl habitat as forest plans were revised and more information about the owl was learned to justify either deviation from the strategy or to support a long-term conservation strategy based on fulfilling critical information needs of the owl. The technical assessment had the following objectives:

1. Present, analyze, and interpret relevant information currently available on the biology of the owl—its distribution, abundance, density, movements, breeding biology, diet, demography, habitat associations, etc.
2. To the extent possible, characterize the attributes of various habitats used for foraging, roosting, and nesting by the owl throughout its range in California.
3. Evaluate current land management practices throughout the range of the owl, recognizing that more detailed information may be available for some land ownerships than for others.
4. Evaluate a range of options to achieve an amount and configuration of suitable habitat to provide for the long-term maintenance of the owl throughout its range.
5. Identify research, monitoring, and inventory programs needed to answer existing critical questions and to provide for adaptive management of the owl in the future.

## Lessons Learned From the Northern Spotted Owl

Although the northern spotted owl (*Strix occidentalis caurina*) is a different subspecies within a different ecoregion, many of the challenges and successes in conservation efforts associated with this federally threatened species over the past 24 years are applicable to the California spotted owl (USFWS 2011). Our assessment makes no attempt to incorporate the large body of work published on the northern spotted owl, but the five primary topic areas of the 2011 Recovery Plan clearly reflect the

critical information needed to address the conservation and management of spotted owl populations and habitat:

1. Conservation of existing spotted owl sites and high-value spotted owl habitat.
2. Ecological forestry and active forest restoration approaches to meet the challenges of climate change and altered ecological processes.
3. The threat posed by barred owls (*Strix varia*) and management options to address those threats.
4. The potential need for state and private lands to contribute to spotted owl recovery in areas with substantial mixed ownership.
5. Development of a population and habitat modeling framework as a decision-support tool to better inform future land management decisions.

## **Expanding Challenges in Spotted Owl Conservation**

The complexities of managing habitat that supports viable populations of species associated with mature forests have continued to grow in recent decades. At the time of CASPO, concern about fire centered on sufficient fire suppression measures, climate change was not a primary focus for Forest Service scientists and managers, and as the barred owl had just recently invaded the range of the northern spotted owl, there was uncertainty about its impact on the spotted owl (Verner et al. 1992). Since CASPO, we have observed significant declines in spotted owl populations across its range (Conner et al. 2013, LaHaye and Gutiérrez 2005, Tempel et al. 2014; chapters 4 and 8); an increase in the size and severity of wildfires (chapter 5); a growing recognition of the essential role of active fire in forest restoration, and the dual role that fire can play as a destructive and constructive process (chapters 5 and 9); the challenge of balancing forest restoration using fire and increasingly strict air quality objectives and constraints (Quinn-Davidson and Varner 2012); a clearer understanding of the impact of high-severity burned forests in sustaining owls in a dynamic landscape where fire is likely to become more prevalent (Bond et al. 2009; chapter 7); the emergence of diseases, such as West Nile virus (Ishak et al. 2008; chapter 7); and the significant threat that the invasion of the barred owl has on spotted owl population persistence (Gutiérrez et al. 2007; chapter 7). Against this background, uncertainty posed by climate change in California, most notably in the form of extended droughts, is predicted to exacerbate many of these observed challenges in addition to unforeseen effects on owl populations and their prey (Miller and Stephenson 2015). These emerging issues have joined, not replaced, those

recognized at the time of CASPO, namely the impact of habitat loss and fragmentation through logging and urbanization, the uncertain impact of water diversions to serve increasing demands with (now) decreasing supplies, and the uncertainty of imperfect information about the ecology, vulnerabilities, and primary drivers of population trends. Perhaps the most troubling of all is the overwhelming evidence that uncertainties about how to conserve the California spotted owl are now confounded by the uncertainty about how to conserve forest ecosystems in light of the increasing threat of high-severity fires and climate change. This excerpt from the northern spotted owl recovery plan pertaining to habitat conservation and management in dry forest ecosystems illustrates the conservation conundrum we face (USFWS 2011: III-20):

Changing climate conditions, dynamic ecological processes, and a variety of past and current management practices render broad management generalizations impractical. Recommendations for spotted owl recovery in this area also need to be considered alongside other land management goals—sometimes competing, sometimes complimentary—such as fuels management and invasive species control. In some cases, failure to intervene or restore forest conditions may lead to dense stands heavy with fuels and in danger of stand-replacing fires and insect and disease outbreaks. In general, we recommend that dynamic, disturbance-prone forests ...should be actively managed in a way that reconciles the overlapping goals of spotted owl conservation, responding to climate change and restoring dry forest ecological structure, composition and processes, including wildfire and other disturbances.

The management of forested landscapes entails many considerations. In addition to the concerns raised above, there are other species of conservation concern (including candidate species for listing under the Endangered Species Act of 1973 [ESA 1973]) that also occupy the mid-elevation multilayered, mature forests that California spotted owls use. In particular, the pacific fisher (*Pekania pennanti*), another old-forest-associated species of concern, is found in the southern Sierra Nevada where its range almost entirely overlaps that of the California spotted owl. Therefore, management of California spotted owl habitat may have complementary or competing objectives with other old-forest-associated species. This could be especially important when considering the cumulative effects of multiple conservation strategies on meeting ecosystem management and ecological restoration objectives.

## **This Conservation Assessment**

This conservation assessment for the California spotted owl was initiated in response to a request by the Pacific Southwest Region of the USFS to provide a scientific foundation for a comprehensive conservation strategy for National Forest System lands within the owl's range. The intention of this assessment was to provide a comprehensive overview of the best available scientific information about the ecology, habitat use, population dynamics, and existing and potential threats throughout the geographic range of the California spotted owl, as well as its implications for land management within the context of the broader landscape. It was also intended to specify and clarify to the degree possible the complex interactions of owl populations, forests, and landscape dynamics, and address these topics from the perspective of different areas of scientific expertise in order to provide a more comprehensive perspective on management challenges and opportunities. In a few cases, different authors reached different conclusions about particular topics; when this occurred, authors worked together to provide additional clarification on the range of perspectives and their respective foundations. Ideally, this assessment will help inform future options for management ranging in scale from site-specific projects to large landscapes to the entire range of the owl. Land managers must reconcile many objectives and demands, including conserving the full suite of native species associated with forest ecosystems within their jurisdiction. We intended this assessment to inform that reconciliation.

The geographic coverage of this assessment includes the entire range of the subspecies—the Sierra Nevada, the Transverse Ranges of southern California, and portions of central coastal California (Gutiérrez et al. 1995). However, the majority of the owl population occurs in the Sierra Nevada, and this is also where most of the new information has been generated over the past 20 years. Thus, this assessment is focused primarily on the Sierra Nevada, with a largely independent update of the southern and coastal California populations addressed only in chapter 8.

The Owl Assessment Team members, the authors of this assessment, were assembled to represent expertise relevant to the conservation and management of the California spotted owl and its habitat (see appendix). This team provided expertise not only in owl biology but also in several related disciplines, including climate change, fire and fuels management, forest ecology, remote sensing, and vegetation ecology.

The forests in which the owl lives have changed significantly in composition and structure over at least the past 100 years as a result of human activities and will be subject to additional human influences and other stressors in the coming decades. This assessment provides a comprehensive summary of the state of knowledge in

relevant topic areas, many of which were also addressed in CASPO. The latest understanding of the biology of the spotted owl is provided in chapter 2. Chapter 3 provides a thorough reporting of the current knowledge of habitat associations and use. Population distribution and trends based on demographic monitoring and other research results are summarized in chapter 4. The assessment then transitions to the environmental context for owl populations and habitat, starting with an overview of current and projected future forest conditions in mid-elevation conifer forests of California in chapter 5, followed by habitat mapping and analysis technology in chapter 6. Chapter 7 summarizes the primary threats that owl populations and habitat face currently and into the foreseeable future. Given the relative paucity of information on spotted owl population status and trends in southern California, an overview of what we do know is presented entirely in chapter 8. The assessment concludes with a synthesis and interpretation of California spotted owl research within the context of broader land management challenges presented in chapter 9.

This assessment does not evaluate explicit habitat management options for the long-term maintenance of the owl throughout its range, but rather it attempts to identify key elements that appear to be critical to the success of any conservation effort, and it explores implications for future research and management. This assessment does not provide an evaluation of monitoring and inventory program needs necessary to provide for adaptive management of the owl, but it does identify future research investments that could reduce key uncertainties as management proceeds.

Although this assessment addresses only one species, it reflects the situation facing old-forest ecosystems and associated species in dry forest ecosystems of the Sierra Nevada and southern California. The essential role of fire in restoring the resilience of forests in the range of the California spotted owl, juxtaposed with the threat that high-intensity wildfire poses to suitable spotted owl habitat given current forest conditions, and the uncertainty of impacts to owls of forest treatments to reduce the risk of high-intensity fire creates challenges for both scientists and managers. The role of forest management and the use of managed wildfire and prescribed fire emerge as dominant themes across the chapters of this assessment, and the final chapter provides an evaluation of common ground between owl conservation approaches and management to restore forest resilience.

## **Information Sources Consulted**

Substantial monitoring of owl populations, field research, and analysis of data have been completed since CASPO. Five geographically distinct demographic study areas were established either before or approximately coincident with CASPO to

examine apparent survival probability, reproductive output, and population trends. The five areas were on the Lassen National Forest, Eldorado National Forest, Sierra National Forest, the adjoining Sequoia and Kings Canyon National Parks, and the San Bernardino Mountains. These study areas represented a broad spectrum of habitat and management conditions in the Sierra Nevada and the largest population in southern California (Franklin et al. 2004). Although the San Bernardino Mountains demography study ended in 1998, it has been the source of the majority of information from southern California. A summary of the latest scientific information on the southern California owl populations was developed in 2011 by the San Bernardino National Forest<sup>2</sup> but not published. Many other research projects were conducted throughout the range of this subspecies within this time period, contributing significantly to the current body of knowledge about the owl.

The information used in this assessment is based almost exclusively on peer-reviewed, published literature. The team was not solely dedicated to this task but, as it was a minor allocation of their professional responsibilities, we limited the review to (1) published information, (2) only a limited scope of northern spotted owl work, and (3) no data compilation or analysis of raw data. As such, it was a much more limited and constrained (by time and money) effort relative to CASPO. It was not possible within the constraints of this assessment to access unpublished reports and archived data that may exist and that could be relevant to this assessment. Resources used to inform this assessment are individually referenced and cited in each chapter.

## The Process and Product

This assessment is published as a Pacific Southwest Research Station (PSW) general technical report, as was the previous CASPO report. General technical reports provide the opportunity for a detailed reporting of information, a rigorous peer review process, and an easily accessible outlet. The technical peer review was conducted by an anonymous, independent group of four scientists who represented the same scientific disciplines covered by the content of the report. The comments of the reviewers were individually addressed through a scrupulous revision process. The document also was subject to management review by Region 5 staff, and to a policy review by PSW.

---

<sup>2</sup> Eliason, E.; Loe S. 2011. Unpublished report. On file with: USDA Forest Service, San Bernardino National Forest, 602 S Tippecanoe Ave., San Bernardino, CA 92408.



## Literature Cited

- Bond, M.L.; Lee, D.E.; Siegel, R.B.; Ward, J.P. 2009.** Habitat use and selection by California spotted owls in a postfire landscape. *Journal of Wildlife Management*. 73: 1116–1124.
- Conner, M.M.; Keane, J.J.; Gallagher, C.V.; Jehle, G.J.; Munton, T.E.; Shaklee, P.A.; Gerrard, R.A. 2013.** Realized population change for long-term monitoring: California spotted owl case study. *Journal of Wildlife Management*. 77: 1449–1458.
- Endangered Species Act of 1973 [ESA]; 16 U.S.C. 1531–1543, 1538-1540.**
- Federal Register. 2012.** National Forest System Land Management Planning. 77(68): 21162–21276.
- Franklin, A.B.; Gutiérrez, R.J.; Nichols, J.D.; Seamans, M.E.; White, G.C.; Zimmerman, G.S.; Hines, J.E.; Munton, T.E.; LaHaye, W.S.; Blakesley, J.A.; Steger, G.N.; Noon, B.R.; Shaw, D.W.H.; Keane, J.J.; McDonald, T.R.; Britting, S. 2004.** Population dynamics of the California spotted owl (*Strix occidentalis occidentalis*): a meta-analysis. *Ornithological Monographs*. 54.
- Gutiérrez, R.J.; Cody, M.; Courtney, S.; Franklin, A.B. 2007.** The invasion of barred owls and its potential effect on the spotted owl: a conservation conundrum. *Biological Invasions*. 9: 181–196.
- Gutiérrez, R.J.; Franklin, A.B.; LaHaye, W.S. 1995.** Spotted owl (*Strix occidentalis*). In: Poole, A.; Gill, F., eds. *The birds of North America No. 179: life histories for the twenty-first century*. Washington, DC: The Philadelphia Academy of Sciences and the American Ornithologists' Union.
- Ishak, H.D.; Dumbacher, J.P.; Anderson, N.L.; Keane, J.J.; Valkiūnas, G.; Haig, S.M.; Tell, L.A.; Sehgal, R.N.M. 2008.** Blood parasites in owls with conservation implications for the spotted owl (*Strix occidentalis*). *PLoS ONE*. 3(5): e2304.
- LaHaye, W.S.; Gutiérrez, R.J. 2005.** The spotted owl in southern California: ecology and special concerns for maintaining a forest-dwelling species in a human-dominated desert landscape. Gen. Tech. Rep. PSW-GTR-195. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 11 p.
- Millar, C.I.; Stephenson, N.L. 2015.** Temperate forest health in an era of emerging megadisturbance. *Science*. 349(6250): 823–826.

**National Forest Management Act of 1976 [NFMA]; Act of October 22, 1976; 16 U.S.C. 1600.**

**Quinn-Davidson, L.; Varner, J.M. 2012.** Impediments to prescribed fire across agency, landscape and manager: an example from northern California. *International Journal of Wildland Fire*. 21(3): 210–218.

**Spies, T.A.; Hemstrom, M.A.; Youngblood, A.; Hummel, S. 2006.** Conserving old-growth forest diversity in disturbance-prone landscapes. *Conservation Biology*. 20: 351–362.

**Tempel, D.J.; Gutiérrez, R.J.; Whitmore, S.A.; Reetz, M.J.; Stoelting, R.E.; Berigan, W.J.; Seamans, M.E.; Peery, M.Z. 2014.** Effects of forest management on California spotted owls: implications for reducing wildfire risk in fire-prone forests. *Ecological Applications*. 24: 2089–2106.

**U.S. Department of Agriculture, Forest Service [USDA FS]. 2002.** Sensitive species—key policies and requirements. 8 p. <http://www.fs.fed.us/r6/sfpnw/issssp/documents/ag-policy/20021200-fs-sensitive-species-key-policies.pdf>. (16 September 2016).

**U.S. Department of Agriculture, Forest Service [USDA FS]. 2004.** Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement, Record of Decision. 72 p. <http://www.fs.usda.gov/detail/r5/landmanagement/planning/?cid=stelprdb5349922>. (16 September 2016).

**U.S. Department of Agriculture, Forest Service [USDA FS]. 2013.** Region 5 regional forester’s 2013 sensitive animal species list. <http://www.fs.usda.gov/main/r5/plants-animals>. (16 September 2016).

**U.S. Department of the Interior, Fish and Wildlife Service [USDI FWS]. 2011.** Revised recovery plan for the northern spotted owl (*Strix occidentalis caurina*). Portland, OR. 258 p.

**Verner, J.; McKelvey, K.S.; Noon, B.R.; Gutiérrez, R.J.; Gould, G.I., Jr.; Beck, T.W., tech. coords. 1992.** The California spotted owl: a technical assessment of its current status. Gen. Tech. Rep. PSW-GTR-133. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 285 p.