Chapter 7: Key Lessons and Caveats

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This report originated from a workshop on long-term postfire ecological restoration held in late 2015 at Yosemite National Park, and a second workshop held at the Natural Areas Conference at the University of California-Davis in late 2016. Workshop attendees included ecologists from the U.S. Forest Service Pacific Southwest Region Ecology Program; scientists from the U.S. Forest Service Pacific Southwest Research Station; and national forest specialists from a variety of fields, including silviculture, soils, and hydrology. In this concluding section, the editors highlight some of the key lessons learned from the process of developing this framework document, which represent important topics for thoughtful consideration and further research.

- **Nonfire disturbances**. Since the first workshop, considerable interest has developed in addressing the topic of nonfire disturbances, particularly widespread bark beetle mortality associated with the extended California drought from 2012 to 2016. New research studies have identified some of the short-term effects of that mortality and possible implications for future fire behavior, but the science on long-term ramifications with and without interventions remains limited.
- **Evaluation of departure**. We found tensions in the process of evaluating departure from reference or desired conditions. The original assessment guidance focused on pre-disturbance vegetative conditions, which were typically based on available and relatively accurate data, such as EVeg. Using recent, predisturbance measures based on EVeg as a reference may bias restoration toward prefire conditions that were already departed significantly from pre-Euro-American conditions. This is especially the case for forest structural and compositional changes related to fire exclusion, including possible reductions in early-successional and other nonconiferous, forest-dominated communities. An approach founded in restoration would ideally focus on departure from reference conditions, such as those described in NRV or historical range of variation assessments. Spatial representations of reference conditions could be represented by biophysical settings in LANDFIRE (although such data may be inaccurate when applied to small areas), Forest Service vegetation maps from the 1930s, soils-vegetation maps from the 1940s and 1950s, or other site-specific historical data.

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- **Interpretation of desired conditions**. The case studies revealed challenges in evaluating departure and developing restoration portfolios based upon desired conditions. Desired conditions may come from aging planning documents that are overdue for revision and do not represent the current state of knowledge (although several plan revisions are currently underway). They may define desired conditions too broadly to assess whether disturbances have resulted in significant departures or to quantitatively direct interventions. Teams charged with making postdisturbance recommendations may attempt to better quantify desired conditions based upon current understandings of NRV as well as projected changes in climate.
- **Future conditions**. It may be important to shift from the natural or historical range of variation as a target to future natural variation by considering how changes in climate may affect ecological site potentials. Although an area may be vulnerable to high levels of moisture stress that could compromise vegetation recovery, can we distinguish whether an intervention would be futile, or whether intervention might significantly increase the chance of recovery? The science regarding future ecological conditions is currently coarse and potentially unreliable, making it difficult to translate into specific management strategies. Furthermore, socially-driven changes in conditions add to that uncertainty (see box 1A). However, science will advance in ways that make it more feasible to determine the conditions under which interventions may be successful, and to enhance those odds.
- **Assessment boundaries.** One case study used watersheds as the boundary for its assessment, while the shrublands the shrublands case studies used fire perimeters as the boundaries of their assessments. It is important to consider whether watersheds, potential operational delineations, fire perimeters, or a terrestrial vegetation unit may be the most appropriate units for restoration planning. As one example, the mixed-conifer case study described desired conditions as "Seventy percent of mixed-conifer forests located within sequoia groves (50 percent outside groves) are dominated by trees greater than 24 inches in diameter (late seral), with 10 percent in early seral, and the remainder (20 to 40 percent) in mid seral stage." Such specific goals require considering the appropriate scale for evaluating departure, and addressing questions such as how far beyond a fire perimeter would such criteria be applied, and how would they be translated to stands within the perimeter?
- **Evaluation criteria.** Criteria used in evaluation may appear somewhat arbitrary or tentative, especially when translated into discrete categories or thresholds (e.g., 40- to 100-ha high-severity burn patches). Conceptually, it

would be more appropriate to evaluate conditions relative to the frequency of patches of various sizes as a distribution relative to a reference time and space. However, managers often need to consider relatively fixed thresholds within a treatment area in order to make pragmatic choices. Regardless, an adaptive management framework is critical for evaluating the outcomes from any postdisturbance interventions over long periods and for better understanding these criteria. To support such a framework, it is important for the assessment to identify information gaps and suggest monitoring priorities to address them.

- **Short- versus long-term view**. The case studies illustrated that in many cases, the data that are immediately available in the wake of a disturbance do not provide the level of detail needed to effectively evaluate ecological departure. For example, short-term assessment relies on indicators that are easily measured after the fire (such as change in vegetation cover and size of high-severity patches), while longer term indicators (such as areas supporting natural regeneration) may be difficult to obtain without sufficient time, resources, and field verification. Consequently, the specific analysis methods used in the evaluation could lead to different views of priorities (see app. 3).
- **Time to develop a restoration strategy**. Although participants in the workshops initially suggested that providing specific guidance about how to implement the framework would yield a more useful product, there remains debate about that approach. For example, some participants suggested that providing guidance regarding how much time to allocate for an assessment (e.g., 30 days) could help managers to plan and execute the framework. On the other hand, such an abbreviated schedule may not fit other contexts, including slower moving disturbances such as bark beetle mortality.
- **Linkage to project planning**. Managers interested in applying the restoration framework in this document to a specific landscape will want to understand how to link products of the restoration framework (e.g., restoration portfolio) with project planning and monitoring. We anticipate future engagement with national forests to further develop an intuitive, practical, and science-based approach. We also anticipate a companion report that will focus more on strategies and tactics for postfire restoration in California forests.
- **Administrative challenges of multiple wildfires**. One of the reviewers of this report noted that national forest staff face a growing challenge in planning because large disturbances (including large wildfires as well as large

Moving from postfire triage to preparations for the next disturbance is important.

beetle outbreaks) are becoming so frequent as well as spatially overlapping (fig. 7.1). As a result, managers may get locked into rapid triage from one fire to the next, with less opportunity to consider long-term, cumulative effects. This trend illustrates the importance of thinking not only in broad landscape terms about restoration needs and opportunities after disturbances, but also how to prepare for the next disturbance. Even where fires may result in some undesirable conditions, they may create opportunities to disrupt the potential impacts of future large disturbances.

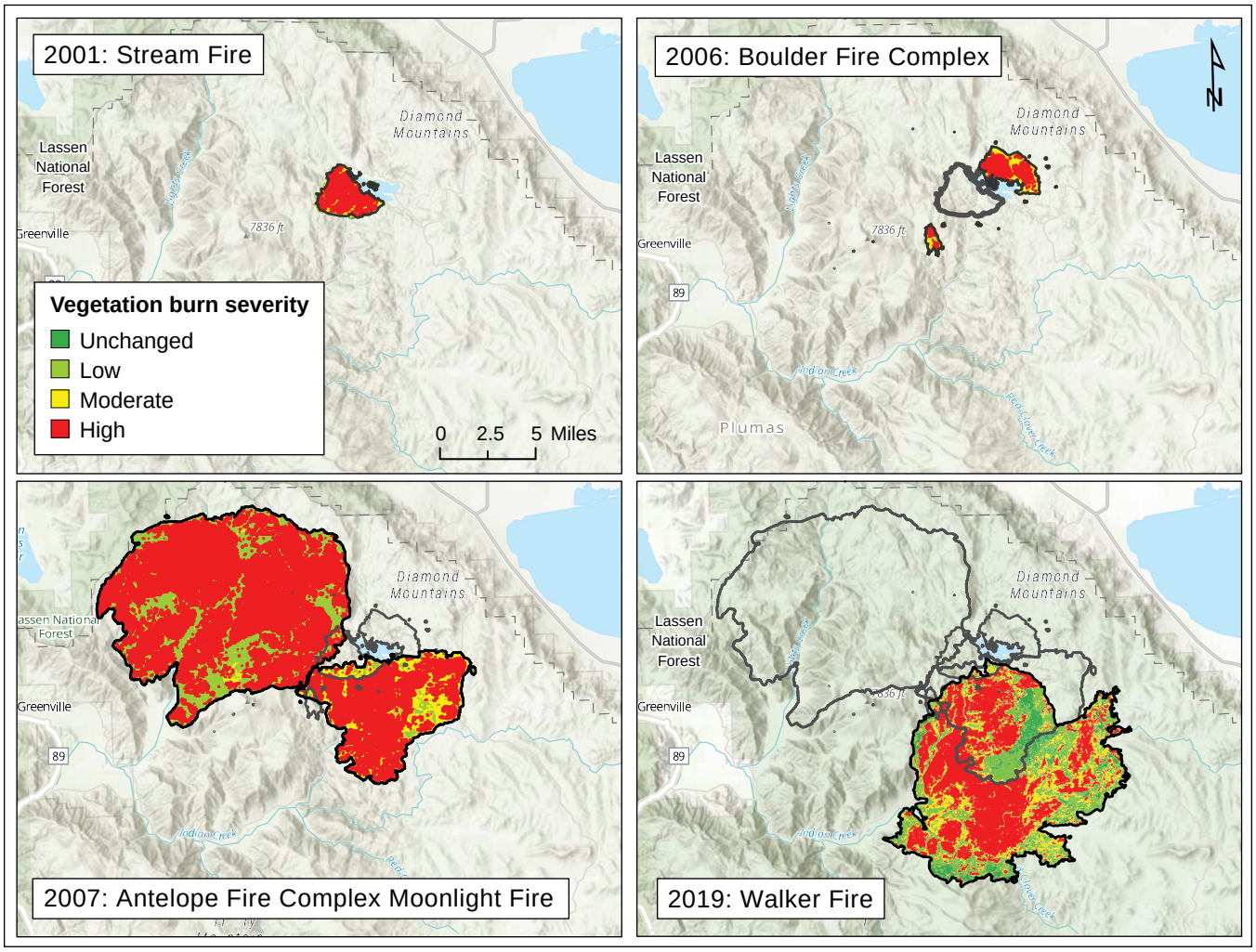

Figure 7.1—Overlapping wildfires between 2001 and 2019 in the Mount Hough Ranger District, Plumas National Forest. Credit: Ryan Tompkins, University of California Cooperative Extension.

- **Need for science and adaptive management**. Managers are clearly concerned that uncharacteristically large and severe fires, the spread of invasive species, and climate change may be shifting conditions into novel and less desirable configurations. We need more science to understand the extent and contexts of these changes, and whether interventions are effective in preventing such shifts. Decisions about whether to invest in interventions need to be informed by data on effectiveness, rather than assuming that interventions are either destined to fail or critical to the success of overarching restoration goals. Adaptive management will be needed in these contexts to facilitate learning and improve postfire planning and restoration.

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