CALIFORNIA FIRE SCIENCE CONSORTIUM

JOINT FIRE SCIENCE PROGRAM

Research Brief for Resource Managers

Mega-disturbances & declining mature forest habitat

Steel, Zachary L.; Jones, Gavin M.; Collins, Brandon M.; Green, Rebecca; Koltunov, Alexander; Purcell, Kathryn L.; Sawyer, Sarah C.; Slaton, Michele R.; Stephens, Scott L.; Stine, Peter; Thompson, Craig. 2022. Mega-disturbances cause rapid decline of mature conifer forest habitat in California. Ecological Applications 33(2):e2763.

https://www.fs.usda.gov/research/treesearch/65411

Mature dry conifer forests, characterized by large fire-resistant trees, support mature forest specialist wildlife like the spotted owl and fisher, as well as store large amounts of carbon needed to mitigate climate change. Historically, these forests were adapted to and maintained by frequent, low- to moderate- intensity fires ignited by lightning or Indigenous peoples. However, fire suppression and exclusion in the 20th and 21st centuries allowed for build-up of understory vegetation, including dense small fire-sensitive trees and shrubs. This accumulation has resulted in excess surface and ladder fuels, and increased competition for water. Additionally, historic

Management Implications

- Rx fire, cultural burning, & ecologically-informed thinning may be necessary to conserve mature forests against worsening mega-disturbances
- Resilience treatments should focus on removal of fine fuels and small trees, leaving large fire-resistant trees important for specialist wildlife
- Fire suppression only management is increasingly failing to protect mature forest habitat

logging of large trees limited the contemporary extent of mature forests in the western United States. These changes to forest structure, plus a warming climate, pose a threat to remnant mature forests and associated wildlife.
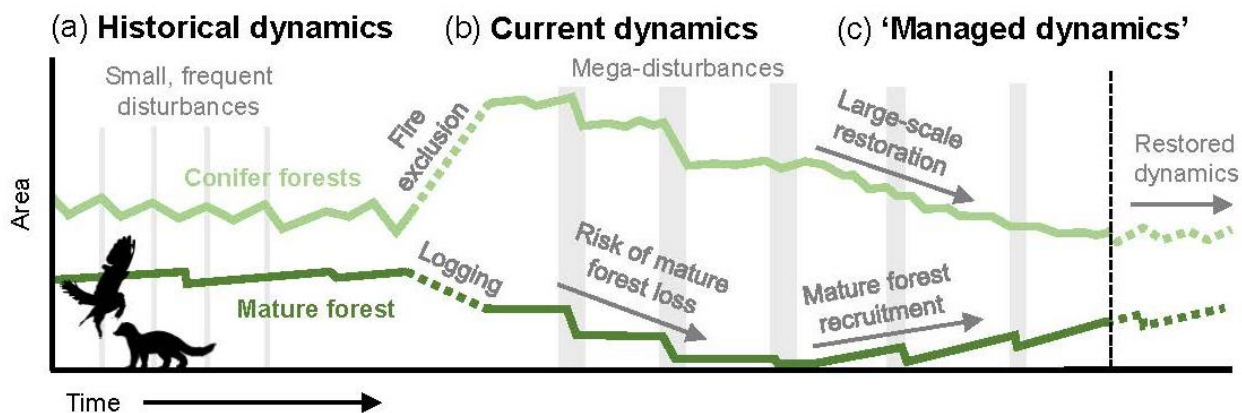

Figure 1. Conceptual figure showing trends in areas of conifer forests and of mature conifer forest habitat under regimes of (a) historic, (b) current, and (c) potential future dynamics (achieved via "managed dynamics").

Between 2011 and 2020, canopy cover across 30 percent of conifer forests of the southern Sierra Nevada declined, changing to either sparse woodland/savanna or in many cases to non-treed vegetation. This change was attributed to compounding megafires, a historic drought, and drought-associated beetle attack. Mature forest habitat with at least 40% canopy cover and tall trees declined by 50 percent, transitioning to lower-density forest or non-forest vegetation. Changes were particularly pronounced among the densest mature forests (>60% canopy cover), which declined by 85 percent over this period.

Spotted owl Protected Activity Centers (PACs), also saw dramatic declines with a loss of 49 percent of their 2011 canopy cover, whereas non-PAC areas declined less - by an average of 42 percent. Some forests that persisted despite low to moderate severity fire may have experienced some restoration of resilience to future disturbances. However, much of the region's conifer forests remain susceptible to severe disturbance without active management for beneficial disturbance dynamics.
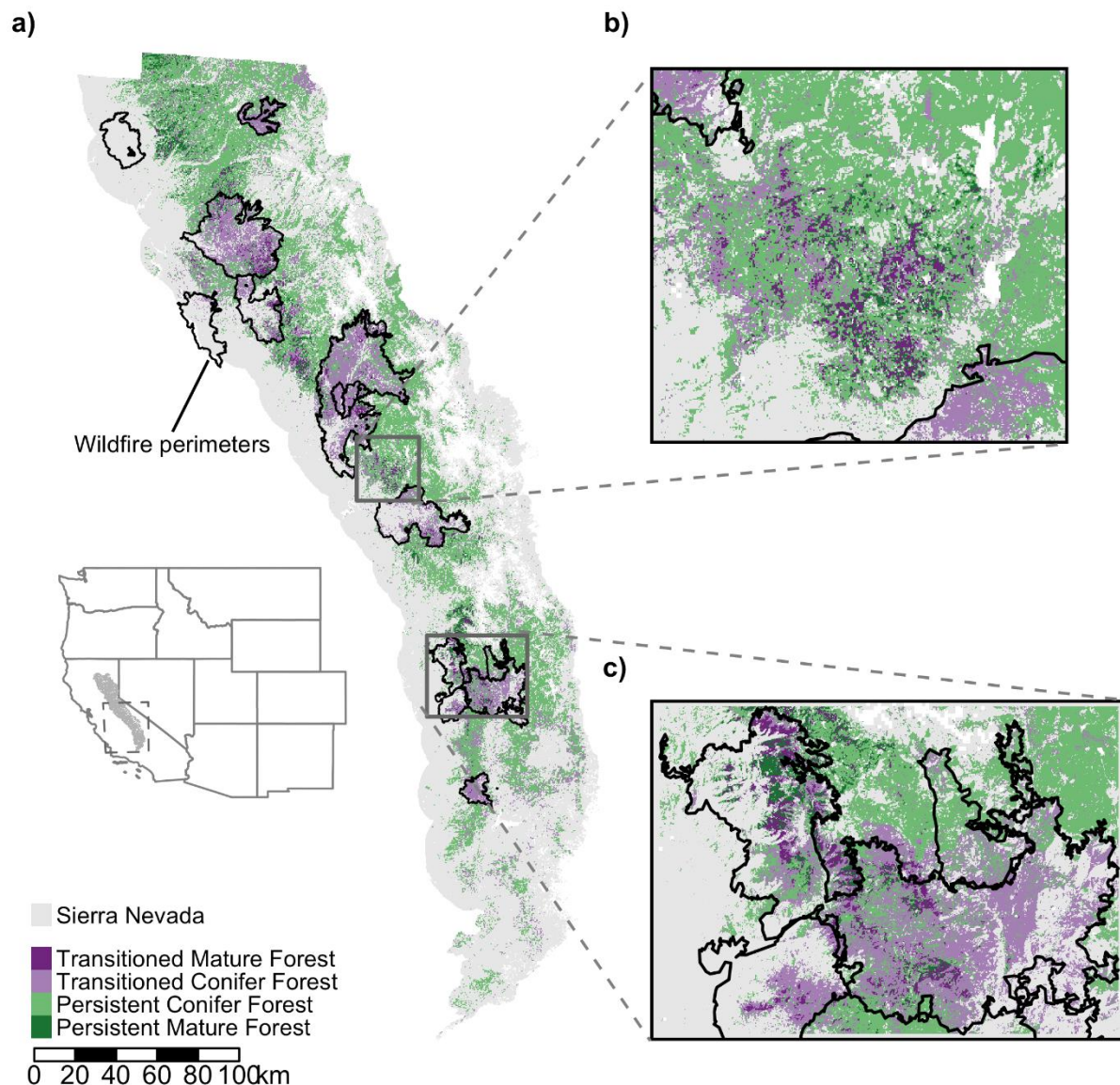

Figure 2. Map of all conifer and mature conifer forest habitat transitions due to drought and wildfire mortality between 2011 and 2020.