CALIFORNIA FIRE SCIENCE CONSORTIUM

# *Fire-caused Vegetation Type Conversion in California: A Workshop Summary*


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## Workshop Objectives:

- Document known cases of VTCs in the study region, distinguishing degrees of conversion
- Identify the underlying mechanisms that lead to VTC as an emergent response and conditions that appear to promote its inverse (e.g., resilience)
- Articulate current and future consequences and management responses

## Vegetation Type Conversion (VTC) is:

- a continuing process resulting from triggering events
- highly dependent on context (e.g., where it happens, what antecedent conditions/values were)
- complicated by legacies of fire suppression and compounded by interacting stressors (e.g., fire combined with insect outbreaks and drought)

In December 2019, partners from the U.S. Geological Survey, University of Arizona, and EcoAdapt hosted a two-day workshop in Sacramento, California, to discuss observations of and management options for fire-caused vegetation type conversion (VTC). The workshop provided an important opportunity for sharing the state of the science and management practices pertaining to VTC in California, and discussing research and management needs. This workshop, the second in a series, was held as part of the broader *Understanding Fire-caused Vegetation Type Conversion in Southwestern Conifer Forests under Current and Future Climate Conditions* project, funded by the USGS Southwest Climate Adaptation Science Center; the first workshop was held in Tucson, AZ in March 2019. The goal of the project is to identify and fill knowledge gaps on fire-caused VTC to better inform research and management across the southwestern United States. This workshop summary synthesizes the workshop discussions and outcomes, including documenting observations of VTC, management options, and research needs.

*Workshop participants during mapping exercise.*

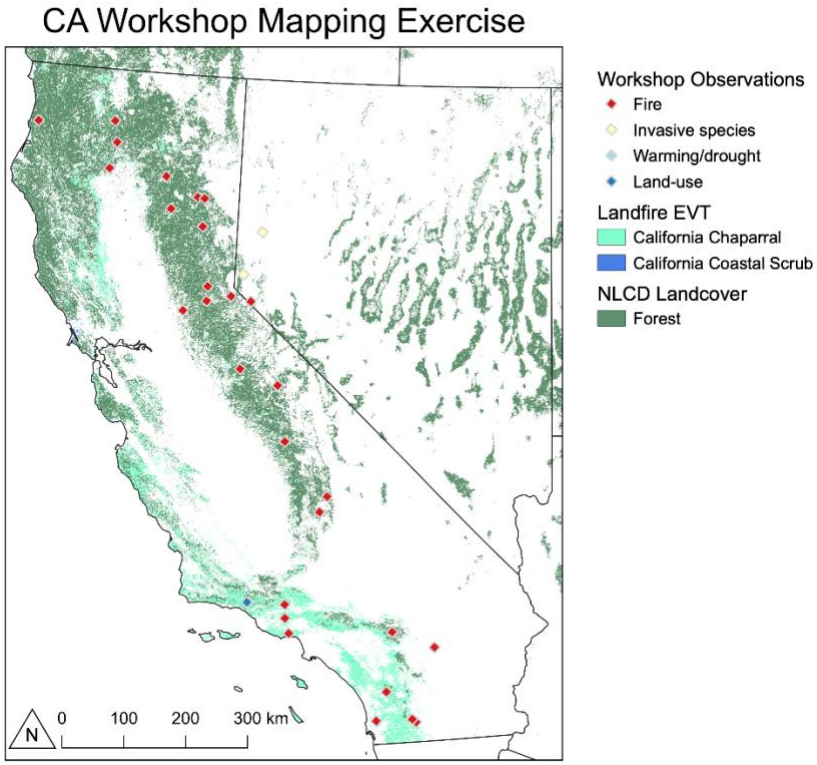
**Background:** Increasingly common large and severe fires in the Southwest are often followed by VTCs where once-dominant vegetation fails to return to its pre-fire state. Case studies have documented abrupt transitions from forests to shrublands or from

shrublands to grasslands. In some cases, these transitions may be persistent and are associated with potential losses in biodiversity, ecosystem services, and cultural values. VTC is often initiated by accelerated mortality of overstory trees from severe wildfire exposure combined with climate stress (van Mantgem et al. 2018, 2020). Understanding the mechanisms that contribute to VTC as an ecological response to high-severity fires, as well as those that promote resilience, are critical to better inform on-the-ground management actions.

**Workshop Purpose:** The workshop convened land managers, practitioners, and scientists from regional agencies and organizations to discuss observations and insights on VTC mechanisms and management responses in California's forests. Outcomes from the workshop reflect the perspectives of 27 participants from 15 organizations, including federal and state agencies, universities, and nonprofit entities (see participant list). Discussions focused on observations of VTC, management implications, and research needs and tools.

**Discussion #1: Observations of VTC**

Evidence from firsthand accounts, observations, and modeling indicate that wildfire, along with other factors such as drought, insects, and disease, play an important role in type conversions in California. During a mapping exercise, participants identified specific locations where VTC has occurred and may be occurring across the region, along with details about transitions to new ecological community types that may be indicative of VTC. These observations include high-severity fires driving shifts from mixed conifer to shrubland in Devils Postpile National Monument, mixed conifer to oak in the Cleveland National Forest, and sagebrush to cheatgrass in the eastern Sierra Nevada.

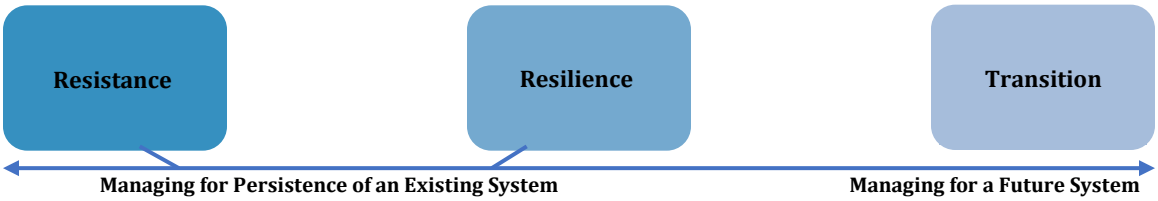



*Regional VTC observations as indicated during the mapping exercise. Drivers of such VTCs include fire, invasive species, insect outbreaks, drought, and human/animal use (e.g., logging, browsing, grazing).*

Participants agreed that VTC may be characterized by dominance of non-native species not previously found in the system, a near-irreversible change from one compositional state to another, or the loss of ecological memory (e.g., propagules or seedlings from previous system) following disturbance. The group had a focused discussion on the concept of ecological transformation, defined by the Federal Navigating Ecological Transformation (FedNET) Working Group as "dramatic and persistent shifts in multiple ecological characteristics that alters the flow of goods and services and demands new management approaches." The consequences and management implications of such transformations largely depend on individual and agency management values. For example, the loss of dominant species may hinder conservation objectives but have limited impact on the provisioning of ecosystem services such as water purification and recreational opportunities.

**Discussion #2: Management Implications**

The range of adaptation options available to fire and forest managers and/or practitioners to respond to VTCs exist along the resistance–resilience–transition continuum (Millar et al. 2007; Falk 2017). These options allow decision-makers to manage for ecosystem persistence through aggressive tactics (e.g., prevention of or recovery from VTC) versus managing for a future altered state (e.g., active or passive facilitation of VTC). Management approaches are frequently determined by values, agency culture, risk tolerance, and regulatory restrictions.




Participants discussed justifications for management as well as specific tactics that may support each option. This included efforts to promote **resistance** and **resilience**, which may be undertaken if invasive or non-native species begin to dominate a site, if threatened and endangered species are present that may be acutely sensitive to a VTC, or to support ecosystem services (e.g., wildlife habitat, carbon). Resistance tactics—taken to prevent or limit VTC—include avoiding uncharacteristically severe wildfire, preventing invasive weed establishment, conducting prescribed burns, managing wildfire for resource objectives, and thinning to reduce competition. Resilience tactics—taken to promote recovery from a mortality episode—include seeding and replanting species, identifying and protecting refugia, and preventing post-disturbance soil loss.

Efforts to facilitate **transition** may include passive (e.g., allowing VTC to happen without intervention) and active (e.g., facilitating VTC via planting and seeding) measures. Passive facilitation may occur if and when (1) a system is naturally trending towards a new state, (2) there is limited institutional capacity to respond, or (3) under conditions of high uncertainty about unintended consequences. For example, participants noted that some managers have accepted shifts from native to non-native annual grasslands (e.g., DiTomaso et al. 2007) and chaparral to coastal sage scrub habitats, and in some cases are retaining exotic species such as tamarisk that provide habitat for birds (e.g., Cohn 2005). Active facilitation of VTC may occur if there is a high probability of enhancing ecological function (e.g., removing trees and shrubs from grasslands to improve grassland function) (Millar and Stephenson 2015). Workshop participants discussed examples ranging from planting drought-tolerant sage scrub in chaparral systems to testing the success of coast redwood transplants outside its current range.

**Discussion #3: Key Research Needs & Tools to Support Decision-Making**

The workshop provided an opportunity for scientists, managers, and other practitioners to discuss current and projected risk of VTC, and to share research needs and approaches to better inform decision-making in California. Barriers to effective management of VTC include ecological feasibility of altering trajectories, costs and institutional capacity, the accessibility of some sites, the availability of funding (e.g., amount and timing), and the sociopolitical landscape (e.g., level of acceptance of ecosystem changes from agencies to the public). Opportunities for identifying, responding to, and recovering from fire-caused VTC in a changing climate discussed included:

- Embracing more experimental approaches: “Give your managers 10% latitude for experimentation”;
- Build expertise on VTC mechanisms and management approaches among the workforce;
- Co-locating scientists with land managers and/or practitioners to allow for more on-site collaboration; and

- Synthesizing the state of the science and practices in communications and research briefs to support on-the-ground management.

## Call for Resources

The project team is crafting a Tamm Review for *Forest Ecology and Management* on the mechanisms of ecological resilience that inhibit and drive VTC in Southwestern forests and their relevance to forest conservation and management. In addition, we are collecting case study examples of VTC and management experiences from across the Southwest for a companion journal publication. **If you have examples to share, please consider reaching out to the project team.**

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**Workshop Participants**

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