



## Wildfire-driven conversion in western North American forests

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Photo Credit: Jesse Wooten

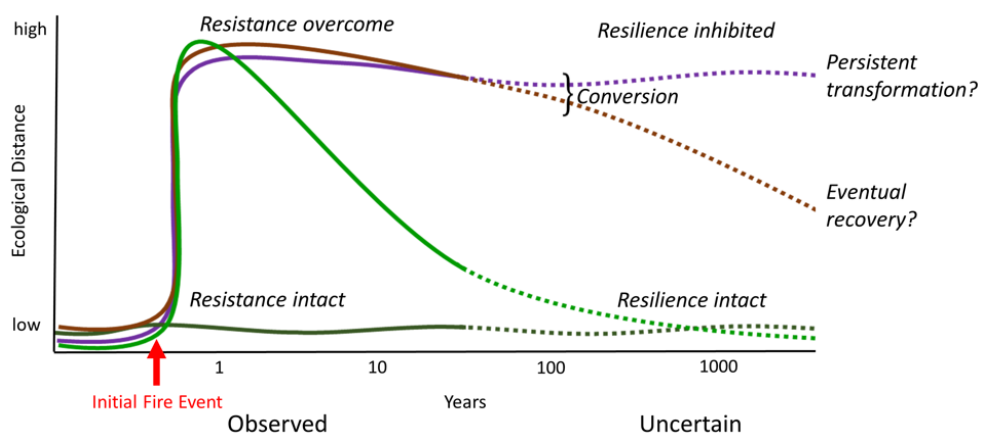
### Management Implications:

- In an era of change, a "resist, accept, and direct" (RAD) framework may be useful in prioritizing intervention strategies in anticipation of fire, during incident management, and postfire landscape management.
- Science to support decisions around resisting, accepting, or directing forest conversion is best formed within coproduction models between scientists, managers, and other stakeholders, where all parties meaningfully engage!

### When a forest burns in a wildfire, should we expect it to return as it was before?

If a fire burns at low severity—such as a surface fire that does little damage to large, thick-barked trees—a forest may remain essentially unchanged. However, following a high-severity fire that kills most trees, the near-term postfire environment may include some combination of dead trees, grasses, re-sprouting shrubs, and tree seedlings. Given similar climate and disturbance regimes, well-understood processes are expected to lead, over time, to the recovery of the prefire forest. But under changing disturbance regimes and climate, can we still count on the return of the forest as it was before fire? A recent paper by 23 scientists in the journal *BioScience* examines this question.

*Hypothetical ecological outcomes of fire. The horizontal axis represents time since the initial fire; the vertical axis represents ecological dissimilarity relative to the prefire state. When resilience processes are overwhelmed, recovery toward a pre-disturbance state may be severely protracted or entirely precluded. Conversion refers to this condition. However, studies of recent postfire dynamics are limited to only a few decades postfire, represented by the solid lines; the time scales of these processes are highly uncertain. The dashed lines represent possible but uncertain future trajectories that cannot be known because of changes in climate, fire regimes, and society.*



## **Key Findings**

- Wildfire-driven forest conversion occurs when ecological resilience of forests to wildfire is overcome, leading to extensive and enduring areas of altered vegetation.
- Conversion is initiated by high-severity fire that removes areas of mature trees, and is maintained by a range of processes that impede tree regeneration, including distant tree seed sources, short-interval fires, or unfavorable postfire climate.
- Management and conservation efforts should align with expectations of increasing forest vulnerability to conversion. In an era of change, the forest that was there before the fire may not return.

## **What is conversion?**

**Conversion** (i.e., type-conversion, site-conversion) is a term used by managers and scientists, and refers to major, extensive, and enduring changes in dominant species, life forms, or functions, with impacts on ecosystem services. Conversion may be initiated by high-severity fire that removes areas of mature trees, and then maintained by a range of processes that impede tree regeneration, including distant tree seed sources, short-interval fires, or unfavorable postfire climate. An emerging body of research from across western North America highlights the strong potential for anthropogenic climate change and other human-induced changes to create conditions leading to fire-driven forest conversion. The prospect of directional climate change beyond historical ranges of variability, and increased frequency and magnitude of extreme disturbance, compels us to consider the possibility of profound and persistent ecological change across forested ecosystems.



*Previously conifer forests: (a) the postfire landscape of the 2002 Hayman fire in Colorado is shrub and herb dominated; (b) After two short-interval high-severity fires, this former ponderosa pine forest in New Mexico is now dominated by re-sprouting shrubs and non-native grasses.*

## **Processes leading to fire-driven conversion**

- Distant seed sources in large patches of high-severity fire can protract tree regeneration.
- Short interval reburning can eliminate post-fire regeneration and expand openings.
- Loss of the forest canopy can result in warmer, drier conditions and increased competition by non-forest vegetation.
- In some settings, high-severity fire can generate vegetation and fuels that is more likely to burn severely again, thereby reducing the potential for forest recovery.
- Climate change, including warming and increased drought severity, can reduce seedling establishment and survival.

## **FOR FURTHER READING**

Coop, JD et al. 2020. Wildfire-Driven Forest Conversion in Western North American Landscapes. *BioScience*, Volume 70, Issue 8, August 2020, Pages 659–673. <https://doi.org/10.1093/biosci/biaa061>