Severe fires turning forest to shrubland in California

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Penn State researchers work in dense shrubland, called chaparral, that borders a forested area in California. Severe fires are threatening to disrupt the balance between the two landscapes, destroying forest and allowing shrubs to spread. Credit: Catherine Airey Lauvaux

Large tracts of forest in California are being destroyed by severe fires and some may struggle to recover, instead being replaced by dense shrubland, according to researchers.

A new study found that large, intense burns brought on by fire suppression, drought and other factors may result in historically forested areas of the state changing to shrubland. The shrubs are adept at growing after burns and can keep a hold on these large areas long term, even permanently.

"It's a landscape trap—a situation where you can get an alternative stable state," said Alan Taylor, a Penn State geography professor and associate in the Earth and Environmental Systems Institute. "Basically we are switching forest to a permanent shrubland. And it could happen at very large scales. There's evidence it's happening now."

Small patches of shrubland, called chaparral, existed stably next to forests in the past, maintained by returning fires that would kill any trees trying to retake the land. The surrounding forest burned more often and less severely, and trees would often survive these fires. The dynamic maintained a balance between the two landscapes, the study found.

But that balance may be threatened by uncharacteristically severe fires burning in recent years, which have destroyed large areas of forest and created ideal conditions for shrubland to spread to areas it didn't historically cover.

"Because forest conditions have changed, when they burn now they are switching to large shrublands that can persist," said Taylor, a co-author of the study. "There's not a whole lot known about this dynamic. It's potentially a really big issue. That's what we are trying to tackle—to see if these systems persisted stably next to each other for long periods of time or not, and what controlled the dynamic."

Chaparral is common in the state and often grows alongside forest, but the relationship between the two landscapes and how they interact under modern fire suppression methods has not been well understood. Taylor and a graduate student, Catherine Airey Lauvaux, studied the dynamic and recently published their findings in the journal Forest Ecology and Management.

They examined an area of forest that had never been logged and found fire historically returned to chaparral and forest at different intervals. Shrubland burned less frequently and more severely, killing any trees trying to reclaim the land.

"There seems to be evidence that initial severe burns set up the conditions for the next severe burn," Lauvaux said. "Whatever trees might have come in that decade or so, they are taken out in that second severe burn. It's repeating."

Forest can creep in on shrubland from the edges, but it's a slow process. It takes even longer when there are larger patches of chaparral, like the kind forming after recent severe fires.

For the last 100 years, the U.S. Forest Service has practiced a policy of total fire suppression, or fire exclusion, in forests they manage. This means many smaller fires have been prevented, and things like small trees, forest litter, and underbrush that would have burned has built up over the years. When fires get out of control, this increased fuel load in the forests can lead to burns so intense they kill trees on a large scale.

"We are able to put out most fires most of the time, but the ones we aren't able to put out then get really severe, really fast, and so they then create these shrub fields and other severe effects," Taylor said. "If a fire gets away it creates these really big patches of chaparral. And then they are hard to deal with from a management standpoint. It's hard to reforest

them and they burn again. It's a real challenge."

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