

# Climate Change and Extreme Weather

## PART II: FOREST IMPACTS

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### Extremes Shape Plant Communities

Climate and weather extremes can shape plant communities as much (or even more than) long-term climate trends and they will likely lead to *some of the most immediate and drastic forest impacts*, as the frequency of these events increases with climate change (see [Part I](#)).

### Impact of Extremes on Forests

#### DROUGHT

[U.S. Drought Impacts](#) –The semi-arid forests of the southwest have been studied extensively because they are highly vulnerable to hotter drought. They have already experienced drought-induced mortality via large-scale die-off of piñon-juniper woodlands, with an estimated 2.5 million acres affected since the 1990's. Evidence suggests this region will experience massive forest mortality later in the century.

California has also been in the spotlight for drought, and the effects are illustrative of the conditions we will experience more frequently in the future, as research has shown that anthropogenic warming contributed to the severity of the current drought and is increasing the probability of warm-dry conditions.

[The Real Risk of Climate Change-Type Drought](#) –A recent research synthesis examined all the evidence suggesting that forests have *lesser or greater* vulnerability and concluded that we are most likely *underestimating* global vulnerability to hotter drought. This is, in part, because a number of major drivers that are known with high confidence all point toward more forest vulnerability.

#### EXTREME HEAT

It is well-understood that high temperatures increase the speed and severity of drought stress, by affecting vapour pressure deficit (VPD)—a combination of temperature and relative humidity that represents the 'drying power' of the air and is a key variable in plant

water stress. Generally, the higher the VPD the more water plants lose through transpiration. Climate models consistently predict that VPD and temperature will increase, leading scientists to suggest that rising VPD is one of the biggest threats to plant communities.

#### FLOODS/HEAVY PRECIPITATION

While excess water (due to flooding or water-logged soils) is on the other end of the spectrum from severe drought, it can have similar negative consequences, especially for species that are not well-adapted to those conditions. This kind of forest stress is likely to increase in many places during the next century, as we experience large flood events (esp. in the Northeast and Midwest US) and more heavy precipitation.

### Extremes & the Carbon Cycle

Climate models generally predict that vegetation productivity and carbon sinks will increase in temperate and boreal regions, but new research suggests that extreme events can offset or reverse that trend. When extremes lead to large-scale changes in terrestrial ecosystems (e.g. forest die-off, extensive wildfire) they can create feedbacks that accelerate climate change.

### Conclusion

Extremes may be the source of the most immediate climate change impacts in our forests. More impactful drought due to warmer temperatures and reduced precipitation (or changes in seasonality) will make certain regions vulnerable to forest die-off and, in other regions, extremes may increase forest stress, leading to reduced productivity or vulnerability to insect and disease outbreaks.

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