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The effect of drought on functional traits and diversity in Douglas Fir: snapshots before, during, and after the summer 2018 European drought event

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The summer of 2018 brought a record-breaking heat wave and record low rainfall, resulting in a severe drought in much of northern and central Europe. In the following year, precipitation increased but in many locations remained below average. A temporal study that began in 2017 in a temperate evergreen forest in the Netherlands allowed the opportunity to examine the effects of this drought on functional traits before, during, and after the event. This gave us new trait-based insight into the resistance, resilience, and recovery abilities of the Douglas Fir to drought. During the growing season of 2017-2019, leaves were collected every 2-4 weeks. Functional traits were derived, including total chlorophyll, carotenoids, specific leaf area, and leaf dry matter content. Functional diversity metrics were also derived to examine response to drought. Using ANOVA to compare trait values during the same parts of the season, we found all traits showed significant changes at some point, but chlorophyll and carotenoids had the largest responses to the drought. Chlorophyll concentrations showed a continued decrease into 2019. Carotenoid concentration increased across the years, which has been shown to be an indication of plant stress. Though Douglas Fir has been considered drought resistant, this study reveals that the intensity of the 2018 drought had an impact on its traits and its resilience without sufficient soil moisture relief in the following year. Much attention has been paid to extreme events with climate change; however, it is these events paired with a lack of adequate recovery conditions that can push ecosystems past their tipping point.