EGU21-5765
https://doi.org/10.5194/egusphere-egu21-5765
EGU General Assembly 2021
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Life after recovery: new insights into post-drought compensatory growth and forest recovery dynamics

Thomas Ovenden[1,2], Michael Perks[2], Toni-Kim Clarke[2], Maurizio Mencuccini[3], and Alistair Jump[1]
[1]Stirling Universty , Biological and Environmental Sciences, United Kingdom of Great Britain – England, Scotland, Wales (thomas.ovenden@stir.ac.uk)
[2]Forest Research, Northern Research Station, Roslin, EH25 9SY Midlothian, UK
[3]ICREA at CREAF, Campus de UAB, Cerdanyola del Vallés, Bellaterra, Barcelona, Spain

Large scale losses in forest productivity linked to extreme drought are now being documented globally. With climate change set to increase the frequency, intensity and duration of future extreme events, understanding the impact of drought on forest productivity and the post-drought recovery dynamics of these systems is becoming increasingly important. However, current approaches to quantifying resilience limit our understanding of forest response dynamics, recovery trajectories and drought legacies by constraining and simplifying the temporal scale and resolution of assessment. To advance beyond one of the most commonly used approaches to estimating resilience, we first compared estimates of resilience for Pinus sylvestris trees following an extreme drought by comparing the same resilience index calculated over different pre- and post-drought time scales. We then developed an alternative approach using dynamic regression to capture each individual tree's relationship between climate and growth, which was then used to forecast tree growth annually for the drought year and nine subsequent years, in a scenario where no drought had occurred. Here we present the results of this work, comparing observed tree growth with growth forecasted using dynamic regression at multiple stem heights and stand densities. This approach allowed us to increase the temporal scale and resolution of resilience assessment and follow tree and stand level growth relative to a no-drought scenario throughout recovery and into a post-recovery phase, where we find evidence for significant compensatory growth. The existence of compensatory growth post-recovery reduced estimates of drought induced losses of radial growth, indicating that current approaches risk underestimating tree and stand resilience to drought and overestimate losses in above-ground biomass. Similarly, we provide evidence for a temporal dependency in the stage during recovery at which pre-drought tree and stand attributes such as growth rates, basal area and stand densities were associated with growth resilience. Our results have wide reaching implications for both forest management targeted at increasing resilience, carbon budgeting and our understanding of drought legacy.