

ALL - IUFRO Conference, 21 – 23 September 2022, Vienna, Austria

BOOK OF ABSTRACTS

ALL IUFRO CONFERENCE 2022

**Forests in a Volatile World –
Global Collaboration to Sustain Forests and Their Societal Benefits**



INTERNATIONAL UNION OF FOREST RESEARCH ORGANIZATIONS

HEADQUARTERS, VIENNA AUSTRIA

University of Applied Arts ("Die Angewandte")

A-1030 Vienna, Vordere Zollamtsstraße 7

21-23 September 2022

FOREST DEGRADATION AND RESTORATION SESSION

PRESENTATIONS

How dry is too dry? A retrospective analysis on how global change-type droughts are driving mortality in European forests

Jan Peter George, *University of Tartu, Tartu, Estonia*; **Tanja Sanders**, *Thünen Institute of Forest Ecosystems, Eberswalde, Germany*; **Mathias Neumann**, *University of Natural Resources and Life Sciences Vienna (BOKU), Vienna, Austria*; **Carmelo Cammalleri**, *Joint Research Centre, European Commission, Ispra, Italy*; **Jürgen Vogt**, *Joint Research Centre, European Commission, Ispra, Italy*

European forests are an important source for timber production, human welfare, income, protection and biodiversity. During the last two decades, Europe has experienced a number of droughts which were exceptionally within the last 500 years both in terms of duration and intensity and these droughts seem to leave remarkable imprints in the mortality dynamics of European forests. However, systematic observations on tree decline with emphasis on single species together with high-resolution drought data has been scarce so far so that our understanding of mortality dynamics in the context of drought occurrence is still limited at continental scale. Here we make use of the ICP Forest crown defoliation dataset (ICP level I), permitting us to retrospectively monitor tree mortality for four major conifers, two major broadleaves as well as a pooled dataset of nearly all minor tree species in Europe. In total, we analysed more than 3 million observations gathered during the last 25 years and employed a high-resolution drought index which can assess soil moisture anomaly based on a hydrological water-balance and runoff model every ten days across the continent. We found significant overall and species-specific increasing trends in mortality rates accompanied by decreasing soil moisture. Previous-year soil moisture anomaly had a stronger influence on mortality rates than current-year soil moisture, suggesting that legacy effects (either physiological or caused by secondary biotic agents) play a key role in actual forest decline. Remarkable peaks in mortality occurred simultaneously in Norway spruce and Scots pine (2004, 2018, 2019), but were largely asynchronous in broadleaves. Mortality rates in Norway spruce and Scots pine have increased by 60% and 40%, respectively (period 2010-2020 compared to 1995-2009). Oak (*Quercus robur* and *Q. petraea*) as well as Silver-fir (*Abies alba*) showed lower mortality and only a moderate upward trend. We conclude that mortality patterns in European forests are currently reaching a concerning upward trend which could be further accelerated by the occurrence of future global change-type droughts.