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How does drought-related mortality affect conifer species? The role of historical management practices on the current response of trees to climate

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The hypothesis that conifer-like related functional traits might be especially vulnerable to climate change associated stress events (i.e. more frequent and intense droughts) is increasingly spreading. However, little attention has been paid so far on how management practices may be interacting with this perception. We studied secondary growth time trends of Abies alba Mill. (Silver fir), Pinus nigra Arn. (Black pine), and Pinus sylvestris L. (Scots pine) trees to analyse their responses to severe climatic events (i.e. droughts) by taking into consideration the historical management practices to which they have been subjected to. All three conifer species considered here come from the Romanian Carpathian Mountains and have recently suffered important mortality rates that picked in 2012, when a severe drought event was registered in the area. Each of the three species is represented by three different sites, where wood cores have been sampled from pairs of living and standing dead trees. Silver fir forests are natural and are located within their natural range, while the Black and Scots pine forests were all planted in late 19th, early 20th century replacing broadleaf species, being thus outside their natural range and climatic optimum. Preliminary results of our study show that drought-related mortality affected all three species. Nevertheless, Silver fir trees that died were those that grew less in the last decades, while those that survived showed no signs of growth decline, a pattern paralleled by a good resilience to drought. On the other hand, the Black and Scots pine trees that died or survived showed a very similar growth decline (i.e. low growth rates), pointing out that even those individuals that have survived recent drought events might not be able to cope with future water stress conditions. To conclude, conifers do seem to be vulnerable to climate change related stress events, but many of the conifers that undergo increased mortality rates may be actually conifers that have been planted outside their natural distribution range, a fact that appears to maximize their vulnerability to severe climatic events such as droughts. The management history of a forest must, therefore, be taken into account in order to better understand the increased mortality rates that we are nowadays observing and to better plan future practices in order to protect them.