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Seasonality matters - The effects of past and projected seasonal climate change on the growth of native and exotic conifer species in Central Europe

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Abstract

Norway spruce is one of the economically most important tree species in Central European forestry. However, its high susceptibility to droughts poses a strong challenge to its cultivation under future conditions with likely more frequent and prolonged droughts and shifts in the seasonal climate. To compensate for expected losses of forest areas suitable for the cultivation of spruce, more drought-tolerant species are required. Silver fir and Douglas fir are two potential candidates, which promise lower drought susceptibility and equal or even higher yield when compared to Norway spruce.

Using the Black Forest as a regional case study, we assessed the effects of seasonal climate change, including drought stress, on tree-ring width formation of these three economically relevant conifer species over the last 60 years. In addition, we projected potential species-specific growth changes under different climate change scenarios until 2100.

Our results suggest that both silver fir and Douglas fir will possibly experience growth increases in a warmer future climate, as predicted under the 4.5 and 8.5 Representative Concentration Pathway (RCP) climate change scenarios, whereas growth of spruce is expected to decline. Moreover, drought susceptibility in silver fir and Douglas fir is lower than in spruce, as shown for past drought events, and

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