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Are Scots pine forest edges particularly prone to drought-stress?

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In 2016, Scots pine (Pinus sylvestris L.) forests experienced a pronounced dieback in several regions across Germany. Being an economically important tree species, a thorough identification of the reasons for this dieback is of high interest. The dieback is likely to be associated with a record drought event which occurred in summer 2015. However, visual observations indicate that forest edges were particularly affected. This observation is supported by a study from Sweden which showed that Scots pine trees growing at a north-facing forest edge expressed a higher water use if compared to trees from the interior (Cienciala et al., 2002). We therefore hypothesize that Scots pine trees are more prone to drought-stress induced dieback when growing at the forest edge.
To test this hypothesis, we investigated the growth performance of Scots pine across three affected stands in Franconia, southern Germany. The stands were selected to represent differing conditions along a gradient of forest fragmentation, ranging from the forest interior, over a forest edge situation, to a small forest island. By means of dendroclimatology and UAV-borne remote sensing, Scots pine growth performance and vitality was compared among the three stands.
Our results revealed differing Scots pine growth reactions between the forest interior and forest edge as indicated by the identification of different responder groups (Buras et al., 2016). The forest edge and the forest island expressed significantly higher correlations with the drought-index SPEI (Vicente-Serrano et al., 2009) if compared to the forest interior. Moreover, NDVI of Scots Pine canopies significantly decreased towards the forest edge, this indicating lower vitality of corresponding trees.
In conclusion, our results highlight Scots pine to be more prone to drought-stress when growing at the forest edge. This finding has important implications for forest management activities in the context of climate change adaptation, since foresters may need to revise concepts of Scots pine management at forest edges and in forest islands under an increasingly warmer and drier climate.

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