The role of alpha and beta diversity in buffering the effects of intensifying natural disturbance regimes

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Idea

Europe’s forest are changing, with intensifying forest disturbances and changing environmental conditions. Increasing tree species diversity has been shown to be an effective measure to adapt forests to changing climate and disturbance regimes. Yet, the spatial grain of mixture to obtain these positive effects isunknown.

Results

Does it make a difference for the impact of disturbances on forest landscapes if tree species are mixed within stands (alpha diversity) or between stands (beta diversity)?

Beta and alpha diversity show similar patterns, reducing disturbance impacts on landscape biomass stocks between 2 and 6%.

Our results thus suggest that mixing tree species between forest stands reduces disturbance impacts, while taking advantage of other positive effects of beta diversity (ecosystem service provisioning, biodiversity).

Positive effects of tree species diversity were stronger under climate change.

Our results thus confirm findings from previous studies indicating that increasing tree species diversity is a potent management strategy to adapt forests to future conditions.

Climate change increased temporal variation of biomass stocks and forest structure for all levels of tree species diversity. However, variation increased most strongly in single species scenarios, indicating that these systems might turn from stable to highly volatile conditions due to climate change.

High levels of tree species diversity buffered increasing temporal variation of biomass stocks and forest structure. Under future climate, biomass stocks and forest structure were most stable (lowest temporal variation) under high levels of tree species diversity.

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Research questions

Does it make a difference for the impact of disturbances on forest landscapes if tree species are mixed within stands (alpha diversity) or between stands (beta diversity)?

Does tree species diversity (gamma diversity) increase temporal stability of biomass stocks and forest structure under climate change?