

Disturbance impacts on forest succession, biodiversity, and ecosystem services in a changing world



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Summary

Forest ecosystems are dominated by long-living organisms with limited ability to migrate in space and time. Rapid changes in the climate system cause an increasing maladaptation of forests to their environment. Besides the direct impacts of climate change on forest ecosystems, climate change also modifies natural disturbance regimes. During the last decades, disturbance activity has significantly increased in many parts of the world, and a further increase as a result of climate change is very likely. Yet there is high uncertainty about the impacts of climate change and disturbance on the conservation of biodiversity and the provisioning of ecosystem services to society.

This thesis aimed to reduce this uncertainty by (i) synthesizing the effects of natural disturbances on biodiversity and ecosystem services in a global literature review, (ii) assessing the long-term development of tree species under varying climate and disturbance regimes by means of process-based landscape modelling, and (iii) investigating the role of climate change and disturbances on a wide range of forest biodiversity indicators in space and time.

I found strongly diverging disturbance impacts on forests: while disturbances increased biodiversity, they decreased ecosystem services provisioning. Simulations of Kalkalpen National Park indicated that tree vegetation and associated biodiversity take centuries to adapt to changed climatic conditions, but also revealed a catalyzing effect of disturbances accelerating adaptation to a changing environment.

I conclude that disturbances create opportunities for ecosystems to reorganize themselves with positive implications for the biodiversity and resilience of future forest ecosystems. Management should focus on the diversification of forests to provide ecosystems with the flexibility to react on changes of the environment and safeguard biodiversity and ecosystem services provisioning in a changing world.

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