Submitted Abstract

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Title	Towards Closing The Seed Dispersal Loop: Does Fine Scale Spatiotemporal Variation In Tree Seed Rain Translate Into Plant Population Structure?
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Abstract

Altered disturbance regimes in forests as well as shifting bioclimatic envelops of tree species create unique challenges in terms of tree regeneration in general but particularly in mountain forests. Increased disturbance frequencies and intensities increase the demand for seeds, and changing climate influences supply and viability of tree seeds. Understanding temporal and spatial aspects of tree seed production and dispersal is thus key to sustaining adequate tree cover in future mountain forests. As the number of long-term studies and the availability of global data sets on tree seed production grow, the understanding of proximate factors driving tree seed production has strongly increased. However, to understand the effect of seed production and dispersal on long-term community dynamics and, ultimately, to evaluate the fitness consequences of different masting and dispersal strategies, it is important to link seed production and dispersal with plant establishment. This is particularly important because processes that act at different stages of dispersal, germination and seedling growth can be uncoupled and even have opposing effects. Here, we use fine scaled (a total of 162 seed traps at two one ha permanent sample plots) long-term (15 year) data on tree seed input on the forest floor of an old-growth mountain forest dominated by Fagus sylvatica and, to a lesser degree, Picea abies and Abies alba and link these to the spatial structure of established tree seedlings and saplings. Using geostatistical methods and point process modelling, we modeled 1) the relationship between annual seed crop and spatial heterogeneity of seed rain, 2) the temporal stability of seed rain hotspots and 3) the spatial relation of seed rain and recruitment into the population. Seed production in all three study species was highly variable across study years and space. Interannual variation in seed production in all three species was tightly correlated with spatial variation of seed rain, as seed crops increased, spatial variation of seed rain decreased. High spatial variability of seed rain for Fagus sylvatica was caused by distinct and stationary seed hotspots, seed input positively predicted the spatial structure of seedlings and saplings for this species. The signature of annual variation in seed rain fades with seedling mortality over time in all three focal species. We found that spatial variation in seed rain interacts with subsequent processes to shape the distribution of seedlings and saplings, but in ways that suggest decoupling of the processes between life history stages.