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Cascading effects of forested area and isolation on seed dispersal effectiveness of rodents on subtropical islands

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Abstract

1. Habitat loss and fragmentation often leads to defaunation of large-bodied mammals, and their loss could trigger release from top-down control or food resource competition for small mammal seed dispersers, which in turn may affect the effectiveness of seed dispersal by altering the number of dispersed seeds or the manner in which they are dispersed. Although rodents are primary seed dispersers in habitat subjected to defaunation, changes in seed dispersal effectiveness of rodents along mammalian defaunation gradients, and empirical support for mechanisms underlying alteration of this ecological process, are unclear.
2. We assessed the direct and indirect effects of forested area and isolation on seed dispersal effectiveness of rodents on 21 study islands with varying levels of defaunation in the Thousand Island Lake, China. We used camera sampling, live traps and semi-quantitative acorn counts to assess occurrence of large-bodied mammal species, relative abundance of small rodent species and seed crop size respectively. Seed dispersal, post-dispersal seed survival, seedling emergence, and seedling survival were estimated by tracking fates of tagged acorns and by planting acorns in exclosures.
3. Forested area had positive indirect effects on seed dispersal effectiveness through defaunation and rodent competition for acorns, whereas isolation had negative direct and weaker positive indirect effects on seed dispersal effectiveness mediated by loss of large-bodied mammals and rodent competition for acorns. Loss of large-bodied mammals negatively affected seed dispersal effectiveness indirectly by virtue of its impact on rodent competition for acorns. Seed dispersal effectiveness exhibited a unimodal relationship with intensity of rodent competition for acorns, peaking at intermediate levels.
4. *Synthesis.* Indirect effects of island attributes mediated by defaunation of large-bodied mammals on small or isolated islands appear to drive altered competition for food among rodents and decreased seed dispersal effectiveness. Altered interactions between acorns and their rodent consumers/dispersers can substantially affect oak population demography in the Thousand Island Lake system. More broadly, our findings highlight the importance to the seed dispersal process of multiple interwoven effects between habitat fragmentation and defaunation of large-bodied mammals.