

Insect diversity responses to forest conversion and agroforestry management

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Abstract

The ongoing loss of pristine tropical rainforests increases the potential importance of agroforestry systems for the conservation of tropical arthropod diversity. Shaded agroforestry systems can still support high levels of biodiversity, even resembling those supported by undisturbed forests, but intensively managed open agroforestry systems may cause severe losses in insect diversity. In this study we evaluate the conservation value of agroforestry systems for species richness and diversity (Simpson's index) of four insect groups at natural forest sites and three different types of cacao-dominated agroforestry systems in Central Sulawesi, Indonesia. The agroforestry systems were characterised by low, intermediate and high diversity of shade trees. Each habitat type was studied with 4 replicates, i.e. 16 study sites altogether.

We compared responses of solitary bees and wasps, dung beetles and lower canopy dwelling beetles and ants. These taxa represent diverse and functionally important insect groups: solitary bees and wasps act as crop pollinators or pest predators, dung beetles as decomposers of mammalian excrements and canopy dwelling beetles and ants include abundant herbivores and predators. High percentages of forest species did not occur in agroforestry systems, but diversity and species richness in agroforests remained as high as or even higher than in the forest lower canopy. Diversity, species richness and abundance of the functionally important dung beetles and canopy ants showed strong resilience against both forest conversion and changes in agroforestry management.

Diversity, species richness and abundance of solitary bees and wasps as well as canopy beetles even seemed to profit from the effects of opening the upper canopy that was related to forest conversion and changes in shade tree compositions. On the latter two groups the effects of opening the upper canopy were stronger than effects of reduced shade tree richness. Based on

our results, we recommend the inclusion of agroforestry systems with a diversity of shade trees in tropical conservation plans in addition to pristine forest reserves. Furthermore, regional differences in local agroforestry management contributed to between 31% (for dung beetles) and 58% (for canopy beetles) of the total species richness, which stresses the importance of conservation policies aimed at a diversity of habitat types on a broader landscape scale.

Keywords agroforestry - ants - beetles - biodiversity - lower canopy - conservation - habitat preference - knockdown fogging - management - pit-fall traps - solitary bees - solitary wasps - trap nests