

Biodiversity consequences of long-term active forest restoration in selectively logged tropical rainforests

ABSTRACT

Forest restoration figures prominently on climate action plans, both in the public and private sector. Restoration has the potential to enhance forest recovery and carbon storage, yet could cause unanticipated alterations of forest biodiversity and functioning. In particular little is known about the long-lasting effects of active forest restoration. We therefore evaluated the effects of such management on adult trees and seedlings of actively restored forest to comparable areas where forest regenerated naturally. We investigated a forest site in Sabah, Malaysian Borneo that is recovering from selective logging between 1981 and 1991. Some of the area has been left to naturally regenerate, and some areas have been actively restored for production purposes between 1994 and 2004 through climber cutting and enrichment-planting of exclusively indigenous tree species. We hypothesized that active forest restoration affects forest diversity and composition negatively (i.e., reduction in diversity and presence of pioneer species), and that the silvicultural interventions had long-lasting effects (i.e., higher density of species that were planted, fewer climbers). Surprisingly, our findings suggest that active forest restoration promoted the recovery of adult tree species diversity, expressed as Shannon Diversity Index, and in particular promoted rare species. In actively restored plots, the number of adult individuals of tree species that were planted was enhanced, and the density of liana seedlings was reduced, demonstrating that these silvicultural interventions were effective and had long-lasting effects on the forest structure. Nevertheless, we could not detect differences in the number of seedlings of species that were planted nor in the density of adult lianas between actively restored and naturally regenerating forest sites. We also did not find differences in the species diversity of seedlings, but we observed a compositional shift in the species community for seedlings that were younger than one year. Furthermore, we did not detect a difference between actively restored and naturally regenerating forest plots in the abundance of the present tree guilds (i.e., pioneer or late-succession species) for neither adult trees nor seedlings, as all of our forest plots were dominated by late-succession species. Our results show that active forest restoration can promote species diversity and highlight that active forest restoration focusing on biomass production does not need to adversely affect biodiversity. This work emphasizes the potential of active forest restoration on biodiversity and potentially other key ecosystem functions which are needed to be restored in order to mitigate climate change and the current ecological crisis.