

Diversity for Sustainable and Resilient Agriculture

A method to study complex agroforestry landscapes : illustration in Madagascar

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Abstract (500 words max):

The transition from shifting cultivation to perennial crop cultivation is observed in many regions across the tropics, to meet environmental and socio-economic challenges. In some areas, smallscale farmers have engaged in crop diversification through agroforestry, a practice that enables production for self-consumption and income, while coping with environmental constraints and heterogeneity. This is the case in a zone of Vavatenina commune of Madagascar, where the Betsimisaraka small-scale farmers have abandoned the traditional shifting rice cultivation on hills (tanety) in favor of agroforestry, mainly based on clove tree cultivation. These different tanety land uses shape complex agricultural landscapes that seems to result from various types of agroforests. Despite the major interest Vavatenina original landscapes may have from a sustainability perspective, its composition and spatial structure have not been studied so far. However, the high heterogeneity of these landscapes, at different scales (the plot, the village territory, the commune), raises methodological challenges. Similarly, scale related environmental factors, such as topography, slope and proximity to the road, appear to play on this heterogeneity, and thus required to be identified and their effect assessed. Our study applied an original method to meet this challenge by combining a landscape spatial analysis with a participatory mapping of agroforests. First, we described the composition and spatial organization of agroforestry at two scales, from that of agroforests in the landscape to that of species within agroforestry plots. Second, we analyzed the effects of topography and isolation level on the landscape and agroforests heterogeneity. We used a remote sensing method to quantify the proportion of the different tanety land uses, and analyze how agroforestry especially fits into the landscape and according to which environmental determinants. Then, we applied a participatory mapping method to study the spatial organization of species in 17 agroforests in a village of the study area. This method gave data on the species richness and the species associations in micro-zones related to topography. The results of the remote sensing analysis highlighted 10 different classes of tanety land uses, including more or less dense diversified agroforests, cloves tree and wood tree plantations. The results also indicated that the type of agroforests, the proportion of space they cover, and their insertion in the landscape differ very strongly between the localities of the study area. It seems that, while some areas have engaged massively in diversified and complex agroforestry, this is not the case in other nearby areas, where other less sustainable land uses seem to be favored (e.g. monoculture). The analysis of participatory maps showed that farmers managed between 8 and 22 species in their agroforests, and that they associated and spatially distributed these species according to topography. The combined results obtained with both methods contribute to better understand the heterogeneity of landscape and agroforests and its determinants. This approach would be of interest for supporting agroforestry transitions in other areas where farmers already engaged in such practices, to make a diagnostic of existing agroforestry and identify where and how support could be brought in priority.