

*People-nature interactions through the lens of local ecological knowledge: an illustration on agroforests in Madagascar*

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As disruptive environmental problems such as droughts, heatwaves, and severe storms continue to grow across the world, scientists and conservationists are beginning to recognize the important ways that local ecological knowledge can help response to these disruptions and help manage natural resources. Local ecological knowledge is especially valuable in agricultural communities, where farming traditions have embedded a deep knowledge of local plant species and strategies for their conservation in light of global environmental challenges. Agroforestry—the mixing of trees and shrubs with traditional crop production—is one agricultural strategy based on local ecological knowledge about sustainable practices that has great potential, particularly in the tropics.

Our research deals with farmers' knowledge on plant diversity management in agroforests through the case study of the Betsimisaraka farmers on the Northern East coast of Madagascar. They cultivate many different plants in clove-based agroforests, in which clove tree is a key species for the local population. In this study, we analyzed farmers' knowledge on plants and different plant functions to better understand what strategies the farmers used to structure their mixture of trees, shrubs, and traditional farm crops.

We conducted the study in a village of the Vavatenina District of Analanjirofo Region, and based our methods on the combination interviews and maps made by farmers of the distribution of plants in their agroforest. Our findings show that these agroforests are the hosts of more than 50 plants species linked to a range of benefits such as income generation, human and animal food, firewood, timber, medicinal uses and climate regulation. The maps show that the way agroforestry farmers spatially organize plant species across their land is in line with their ecological knowledge concerning the adaptation of

the different species to environmental conditions, and concerning their positive and negative interactions between the various plants and clove trees. For instance, lychee tree is widespread in clove-based agroforests as it provides fruit and source of supplementary income, but its canopy brings excessive shade to the clove tree so it is planted on the edge of the fields. Our study hence indicates that farmers' knowledge is key in their decision-making for agroforests management, together with more well-known factors such as the households needs and assets, and the socio-economic context. Our work offers some promising perspectives for the expansion of clove tree cultivation based on win-win systems for food production, economic development, social justice, and for the restoration of formerly forested landscape.



*Fallow deer in beech woodland Credit: Zoe G Davies With some Betsimisaraka farmers from the northern east coast of Madagascar, we conducted surveys in their agroforest, hosted under a shelter made with leaves of traveler's palm. This shelter is their second home during the vanilla ripening period, because they want to protect their production from theft. Credit Juliette Mariel.*



*Agroforestry landscapes of the Vavatenina district on the Northern East coast of Madagascar. Credit Stéphanie M. Carrière*



*In the tsabo (agroforest) of a farmer. Credit Juliette Mariel.*



*The view from the heights of a Betsimisaraka village in the district of Vavatenina. Credit Juliette Mariel.*

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*The view from the heights of a Betsimisaraka village in the district of Vavatenina. Credit Juliette Mariel.*