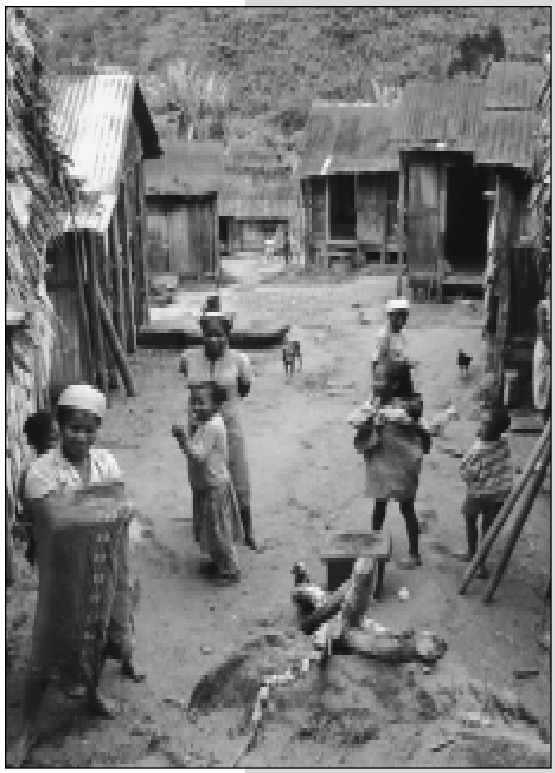
Upland Management without Fire

Farming systems on the eastern escarpment of Madagascar, along the forest corridor between Mantadia and Zahamena national parks, are based on slash-and-burn agriculture, known as *tavy*. Seventy-five percent of the actual land surface on the eastern side of the corridor is secondary vegetation or fallow land and thus subject to periodic burning. With the shortening of fallow periods, soil fertility is not fully restored, resulting in soil degradation and erosion. People are forced to engage in further deforestation to create new agricultural land.

Given the devastating impact of forest or fallow burning on biodiversity and on land productivity, the development of sustainable upland farming and agroforestry systems has to be based on managing uplands without the use of fire. Within this context, I have been studying:

- Cultivation of potential of useful woody rainforest species; and
- Improvement of upland productivity through fireless farming practices.

Initial results on the identification of desirable rainforest species for agroforestry systems were described in the *CIIFAD Annual Report 1998-99* and published in *Agroforestry Systems*.* While species inventory and evaluation are continuing, the current emphasis of my research is on improving upland productivity.



This village is one of three near Beforona where researchers are assessing the influence and evolution of land use practices.

The Impact of Fallows on Productivity

There are three focuses to my research: fallow characterization; land use strategies; and improving productivity.

1) Upland areas are not homogeneous. They encompass a wide variety of natural fallows, soil characteristics, and agricultural productivity. It is important to assess differences in the various fallow systems in order to recommend appropriate techniques for agricultural intensification and tree establishment. Thus, different fallows are being characterized by dominant vegetation, land use history, land productivity, soil properties, and mycorrhizal presence. Mycorrhizal presence in the fallow systems is compared to that in primary forest soils to get an indication of species diversity in relation to increasing soil degradation.

2) To understand how cultivation practices influence fallows, soils and their degradation, we are studying land use and cropping history in three villages with different socioeconomic profiles. Rapid rural appraisal methods were used to assess the evolution of natural resources on both a village and a landscape scale. In each village, cultivation practices of five homesteads have been studied in-depth, examining the history of individual plots.

* E. Styger, J. E. M. Rakotoarimanana, R. Rabevohitra, and E. C. M. Fernandes (1999). Indigenous fruit trees of Madagascar: Potential components of agroforestry systems to improve human nutrition and restore biological diversity. *Agroforestry Systems*, 46:3, pages 289-310.

3) Land productivity is evaluated by comparing the traditional slash-and-burn practice to alternative practices such as slash-and-mulch of fallow vegetation in combination with the application of guano phosphate, known as hyperbarren. This natural and locally available soil amendment contains 20 percent P_2O_5 and 40 percent CaO. The fallow systems selected reflect different stages of soil degradation: a tree fallow dominated by *Trema orientalis*; two shrubby fallows characterized by *Psiadia altissima* and *Rubus mollucanus*; and a herbaceous fallow of *Imperata cylindrica.*

PHOTOS / ERIKA STYGER

Farmers apply locally available inputs to a field in Berano as part of a field experiment with alternatives to traditional slash-and-burn cultivation methods.

An 18-month crop rotation of upland rice-beans-ginger was chosen to cultivate on the mulched plots. Soil samples were taken at the beginning of the experiments, when the fallow was slashed, and after each crop harvest. Yields and the nutrient content of straw and grain are being evaluated. Weed production and the nutrient content of the weeds are also monitored. The 90 experimental plots, which are managed by farmers, are located in the villages of Berano and Ambavaniasy and at the Beforona center.

Farmers have been invited, individually and in groups, to look at the experiments and discuss their adoptability. Participants have included Beforona agricultural workers, Kolo Harena members (farmers associations), and interested farmers. During some of the evaluations, technicians from the Landscape Development Interventions initiative were present as observers. Two videos were made while a group of farmers visited the different plots, one when rice was being grown, and the second when beans were planted. Many informal discussions have been held with farmers about farming practices and innovations. All of this information will be analyzed to provide the basis for recommendations on further technology development.

What Will Result from the Research

This project will create a substantial body of knowledge on upland characteristics and dynamics around the Mantadia-Zahamena corridor. This will support the design of better strategies for sustainable upland management, including agricultural intensification, improved fallow management, and agroforestry practices on different soils and slopes. A next step is to design strategies for on-farm testing of the proposed techniques in collaboration with Kolo Harenas.

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