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Pathways of Rural Development in Madagascar: An Empirical Investigation of the Critical Triangle of Environmental Sustainability, Economic Growth, and Poverty Alleviation

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Most of the world's poor depend directly or indirectly on agriculture for their livelihood. Much-needed increases in agricultural production can, in principal, come about through two pathways of rural development: expanding the area under cultivation or increasing the yield of areas already under cultivation. The first—agricultural *extensification*—does not require increases in agricultural productivity. The second is called agricultural intensification. What causes rural communities to choose between the two, and how can policy help communities achieve environmentally sustainable pathways of development while at the same time improving incomes and alleviating poverty? This paper seeks to shed some light on these complex questions using a descriptive and econometric analysis of community-level data from Madagascar.

The point of departure for the analysis is a theoretical framework that postulates a critical triangle between economic growth, poverty alleviation, and environmental sustainability. The descriptive analysis of community-level data from 200 villages in rural Madagascar shows that the yields of irrigated rice (the major food crop) and agricultural wages declined from 1987 to 1997, while the villages expanded their upland area at the expense of forestlands and the fertility of their upland soils. This paper presents an econometric analysis of the determinants of sustainable rural development that seeks to explain three types of observed development paths: (1) agricultural extensification with corresponding deforestation and soil mining,

(2) agricultural intensification, and (3) rural migration. The results show that improved access to commodity and financial markets and to public services as well as a higher level of social capital in the village can act as determinants that favor more sustainable development paths for use of natural resources.

The analysis in this paper points to a number of implications for policy and further research. Access to member-based financial institutions, such as credit groups, village banks, or savings and credit cooperative societies, plays a significant role in enabling agricultural intensification in Madagascar and the promotion of microfinance institutions for rural households could have beneficial effects on agricultural productivity, poverty, and the conservation of natural resources.

The research further suggests a positive effect of improved access to markets for rice and agricultural inputs on rice yields, upland soil fertility, and the reduction of newly cultivated hillsides. Yet, improved access to output markets for nonrice crops that are grown on upland seems to lead to an expansion of cultivated upland in the short run. As such

market access increases, farmgate prices increase while farmers' transaction costs for selling and buying crops decrease, ultimately pushing up the value of land. Investments in soil conservation will consequently become more economical. Neglecting the build-up of rural infrastructure and markets would only condemn rural villages and households to continue the low-

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input, low-output, land-mining agricultural strategy.

A major incentive for migration is to seek out villages with further possibility for expanding the agricultural frontier. Insofar as migrants search for better living conditions, poverty in the villages and regions sending migrants is a driving force for natural resource degradation elsewhere. Thus, alleviation of poverty through improving access to public services, such as schools and health services, enhancement of domestic trade, and generation of off-farm income opportunities has beneficial effects on the conservation of soils and natural resources. Our analysis suggests that as land becomes scarcer, conflicts about common property may reduce investments in soil conservation because of tenure insecurity. On the other hand, social capital is found to significantly enhance soil fertility, presumably by enabling villagers to agree on more sustainable property rights regimes.

Finally, while the potential of generating employment and income opportunities in Madagascar's rural nonfarm sector should not be underrated, most rural households will probably continue to depend either directly or indirectly on agriculture and related animal production. Agricultural intensification in the major food crops, i.e., rice, cassava, potatoes, and maize, is therefore called for. The results suggest, therefore, the need for a greater role of public policy in improving agricultural productivity through increased investments in agricultural research and extension. Madagascar is a country where the Green Revolution still needs to take place.

Keywords: Madagascar, rural development, agriculture, poverty, income

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