



---

# POLICY SYNTHESIS

for USAID - Bureau for Africa  
Office of Sustainable Development

---

Number 6

November 1995

## PROMOTING FOOD SECURITY IN RWANDA THROUGH SUSTAINABLE AGRICULTURAL PRODUCTIVITY: Meeting the Challenges of Population Pressure, Land Degradation, and Poverty

By

Daniel Clay, Fidele Byiringiro, Jaakko Kangasniemi, Thomas Reardon,  
Bosco Sibomana, Laurence Uwamariya, David Tardif-Douglin

Food Security II Cooperative Agreement between U.S. Agency for International Development, Global Bureau, Economic Growth Center, Office of Agriculture and Food Security and Department of Agricultural Economics, Michigan State University

**BACKGROUND:** The horror of genocide and civil war have turned the world's attention to Rwanda over the past year and a half. But before and beyond that conflict, there were hunger and the slow, grinding poverty of smallholder agriculture in the context of severe land scarcity and degradation.

**OBJECTIVES:** This study addresses the spiraling decline of land productivity and of the rural economy in Rwanda. Three things drive this decline: unsustainable land use practices (intensifying land use without enough investment in soil fertility and land improvement); insufficient nonfarm employment; and rapid population growth. The report focuses on (1) how farm productivity is affected by erosion, organic input use, soil conservation investments, use of fertilizer and lime, and land use strategies; (2) what determines farmers' productivity and conservation investments; (3) what are strategic and policy implications. The study was collaborative between MSU and the Rwandan Ministry of Agriculture, Division of Agricultural Statistics, (DSA/MINAGRI) and used farm survey data.

**FINDINGS:** Rwandan farmers need to sustainably intensify their farming by protecting the soil against erosion, and by enhancing soil fertility through the use of organic matter (manure and mulch), and chemical fertilizer and lime. Without

more input access and use, the inevitable intensification of farming (as holdings grow smaller) will only involve adding more labor and cropping more intensely, both of which will degrade the soils and lead to greater hardship.

### *Context and Yield Patterns:*

- Rwanda's rate of population growth is still among the world's highest (above 3.0 percent annually). Rwanda's average rural population density of 574 inhabitants per square kilometer of arable land is the highest in Africa. Most arable land is under cultivation.
- Per capita food production dropped by 25 percent from 1984 to 1991. Half of the surveyed farmers reported declining productivity. Half of the farmland suffers from moderate to severe erosion.
- Farm sizes are very small—averaging 0.83 hectares per household—and getting smaller with increasing rural population. Use of fragile lands on steep slopes is expanding, and fallow periods are growing shorter.
- DSA/MINAGRI data for 1984-1991 show that, except for maize, yields of all major crops have declined. There has been a strong decline in the yield of tubers, the main source of calories for



the poor. FAO data show that Rwanda lost much of its yield superiority to similar countries in the region during the 1980s— falling behind in cassava, maize, and sweet potato, and, in comparison to some neighbors, in coffee.

- Rwanda still has, however, comparatively high yields in its main cash crops—white potatoes, sorghum, coffee, and tea. Moreover, despite the yield declines of the 1980s, bananas and sweet potatoes still have high caloric yields, and (with maize) hold promise either as food or cash crops.

#### ***Yield Determinants:***

- Farm size affects yields. Compared to larger farms, smaller farms have higher yields (60-95 percent higher, depending on the crop), higher marginal value products of land, and lower labor productivity.

- Smaller farms produce much more on each additional hectare of land than what is paid for a hectare of rented land. This implies land market constraints (access to renting and acquiring land). But smaller farms produce much less for each additional day of farm work than it costs to hire a worker for a day. This implies that labor is "bottled up" on smaller farms and that there are constraints to access to labor market opportunities off-farm.

- Erosion greatly reduces yields. Very eroded farms produce 21 percent less than farms with little erosion (all else equal). This loss rises to 36 percent for farms with a low share of cash crops (bananas and coffee) and with little use of fertilizer or organic matter.

- Soil conservation investments (bunds, terracing, grass strips) greatly increase yields. Farms with high soil conservation investment have 25 percent higher yields than those with a low level (all else being equal). The gain is as high as 33 percent for farms with a high share of subsistence annual crops and high erosion.

- Cash cropping (mainly bananas, coffee, and white potatoes) greatly raises farm yields and

income (by 50 percent). The yield gains from shifting to cash cropping are highest for those with low levels of soil erosion and high use of fertilizer and organic matter.

#### ***Determinants of Land Use, Soil Conservation Investments, and Use of Inputs:***

- Farmers' *land use* tends to be *less erosive*: (1) on steeper slopes (where bananas and coffee and woodlot are grown); (2) on owner-operated (not rented) plots in which households have higher confidence in the long term; (3) regardless of farm size; (4) where farmers have more nonfarm income, which takes pressure off the farmer to "mine" the land; and (5) where farmers have access to extension.

- *Soil conservation investments increase* with the following: (1) more profitable agriculture; (2) higher rainfall (hence the threat of runoff); (3) less land in fallow; (4) steeper slopes; (5) owner-operated (not rented) plots; (6) smaller farms; (7) more nonfarm income (enabling farmers to make more investments); (8) extension (especially for non-traditional types of investments).

- *Use of organic matter and purchased inputs increases* with the following: (1) less steep slopes (because of runoff); (2) owner-operated land (not rented) for organic inputs, which are perceived as having long-term effects; by contrast, chemical fertilizer and lime (perceived to have short-term effects) are applied to owned and rented fields alike; (3) more stable prices (less price risk); (4) smaller farms use more organic matter (as they have less fallow), and larger farms use more fertilizer and lime, probably because they are more able to afford them; (5) more nonfarm income, which increases purchases of inputs and food; (6) more livestock (hence more manure).

**STRATEGIC AND POLICY IMPLICATIONS:** In 1992 the Rwandan government announced its strategic policy goals to raise and sustain rural food security: (1) to increase farm productivity and profitability, (2) to combat soil degradation, and (3) to diversify rural household incomes to increase purchasing power and reduce



pressure on the land. Although interest was traditionally focused on food self-sufficiency, interest in recent years has turned to increasing the output of products that have promising prospects in intra-regional trade.

### *Priority Strategies:*

Rural food security depends on farmers' **sustainable intensification** of production. Growth of agricultural output must keep pace with rapid population growth, and is necessary to build trade ties in the region and abroad. This will require greater use of improved inputs.

We have identified the following priority strategies:

- (1) Greatly increase the use of organic matter (mulch from perennials, manure from animals, and green manure from windbreaks).
- (2) Greatly increase the use of fertilizer and lime (through local production and imports).
- (3) Maintain and increase soil conservation investments such as bunds and terraces to protect input applications and fight erosion.

● We have learned that farmers will not and cannot greatly increase the use of these key inputs and investments without certain **conditions** being present:

- (1) Farmers need restoration of confidence in the short-term after four years of civil war. Without **political stability** it will not be possible to expect productivity investments.
- (2) Agriculture needs to be **profitable** from the output price side and the input cost side. The drop in coffee prices reduced investment, and the high cost of fertilizer made coffee growing unaffordable for many.
- (3) **The general conditions of stability and profitability are, however, necessary but not sufficient—more specific policies and pro-**

**grams** are also needed to enable farmers to make the investments.

(4) Farmers need confidence in the longer term through **secure land tenure**. This means reducing the risk of appropriation, and giving households the right to transact land. This will require a **reform of the land laws**.

(5) Farmers need **knowledge** regarding productivity and conservation practices; we show that **extension** has been, and can be, an effective tool for technology dissemination in Rwanda.

(6) Farmers need **cash income** to buy materials, animals, and labor for productivity and conservation measures. Key sources of cash are **non-farm activities** and **cash cropping**. Nonfarm activities also increase the demand for crops through downstream production linkages. Alternative income sources also reduce pressure on the land. These can be promoted through **nonfarm microenterprise programs**.

### *Program implications:*

Given these priority strategies and conditions, our research points to the following ten **recommendations:**

- (1) **Relief-to-development:** After the war, foreign assistance and government programs need to include building the base of productive assets—perennials and livestock—the stocks of both of which have been reduced by conflict and neglect. Using disaster relief to rebuild herds, and focusing on animal diseases and stabling infrastructure will help. Building stocks of perennials and livestock will increase mulch and manure availability and increase farmer wealth, as well as protect against erosion in the case of bananas and coffee.
- (2) Study and promotion of the **fertilizer/lime subsector** are needed. The focus should be on **constraints to private sector input marketing**. Government regulations and licensing requirements that inhibit fertilizer imports should be examined and potentially eased or eliminated.



(3) **Credit:** Many smallholders suffer from severe cash constraints when trying to buy inputs and make investments. Our findings encourage further study of institutional options that will make secondary town and rural banks, perhaps along the lines of the Grameen bank, more accessible to farmers.

(4) There needs to be more livestock, as well as a shift from extensive to intensive livestock husbandry. Losses from four years of civil war, plus disease and loss of pasture, have decreased herds rapidly over time—hence decreasing manure availability. **Livestock stabling and disease control technologies** are areas where extension and project programming could have a major impact on productivity.

(5) There should be a reversal of historical under-investment in the use of **green manuring** and other agroforestry practices (given successful on-farm trials).

(6) **Integration of fodder and crop production strategies** is poorly developed in Rwanda, by Asian standards. Its promotion would increase manure availability.

(7) Technology research is needed on **intensification of intercropping and mixed cropping techniques** that increase output, incorporate cash perennials, and increase crop density while protecting the soil.

(8) Land rental and absentee landholding effectively lower investments in land productivity. **Revision is needed in land policies and traditional practices** that impede land transactions and contribute to productivity decline, such as laws prohibiting land sales.

(9) Government and donor programming in the population/health sector must **incorporate environmental and productivity issues** into their strategies for population control. Improved food security and environmental conditions can be used to help "market" population control.

(10) The Rwandan Ministry of Agriculture has expressed interest in relating productivity research results to strategies for specialization by region, to increase the overall national output and better position Rwanda for **intra-regional trade**. Our report makes some crop-specific suggestions for zone-level promotion of crops. Moreover, such promotion can be linked to processing infrastructure and input delivery system investments by the government and private firms.

\*Funding for this research was provided by the Food Security and Productivity Unit of the Productive Sector Growth and Environment Division, Office of Sustainable Development, Bureau for Africa, USAID (AFR/SD/PSGE/FSP) and USAID/Rwanda. The research was conducted under the Food Security II Cooperative Agreement Between AID/Global Bureau, Office of Agriculture and Food Security, and the Department of Agricultural Economics at Michigan State University. The views expressed in this document are exclusively those of the authors.

Clay and Reardon are associate professors at Michigan State University. Byiringiro and Kangasniemi are graduate students at Michigan State University. Sibomana and Uwamariya were analysts in the Ministry of Agriculture, Rwanda, and Tardif-Douglin is researcher at Development Alternatives, Inc.

This paper is a summary of a report entitled: "*Promoting Food Security in Rwanda Through Sustainable Agricultural Productivity: Meeting the Challenges of Population Pressure, Land Degradation, and Poverty*" MSU International Development Paper no. 17, 1995. It can be obtained by writing to:

MSU Bulletin Office  
10-B Agriculture Hall  
Michigan State University  
East Lansing, Michigan 48824-1039

This paper is also forthcoming as an SD Publication Series technical paper. It can be obtained through USAID's development information system (CDIE) (catalogue number forthcoming).