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People and Bananas on Steep Slopes Agricultural Intensification and Food Security under Demographic Pressure and Environmental Degradation in Rwanda

By

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BACKGROUND

Rwandan farm households allocate more land to bananas than to any other crop. Most bananas are brewed into beer¹, although brewing greatly reduces the nutritional value of bananas. In a country that suffers from considerable food insecurity, brewing has been seen as antisocial waste. Although several experts on rural Rwanda have recognized that some bananas are eaten and that beer bananas are an important cash crop for some farmers, many have lamented farmers' preference for beer bananas, and argued that bananas contribute little to food security, either because beer sales are inter-farm, failing to increase net incomes in the rural sector, or because most beer is sold by large farmers, rather than by the food insecure. Several observers have predicted that demographic pressure is forcing or will eventually force Rwandan farmers to replace their beer bananas with food crops. While the low levels of soil erosion in densely planted banana groves have frequently been noted, Rwanda's considerable efforts in soil conservation have focused on contour ditches and progressive terraces and have not tried to capitalize on bananas in soil conservation. Since the colonial period, policy-makers have sought to discourage the planting of bananas. Neither beer bananas nor edible bananas have received much attention in agricultural research and extension.

OBJECTIVES

This study examines the changing role of bananas in rural Rwanda as part of a broader question of how rural households are adjusting their cropping patterns, market

¹ Banana beer, also known as banana wine, is a fermented drink with a low (and varying) alcohol content. Also distilled hard liqueur can be made out of bananas, both industrially and artisanally, but unlike the ubiquitous banana wine/beer, the distilled products play little role in rural Rwanda.

participation and food security strategies in response to demographic pressure. The study is based primarily on nation-wide farm household survey data collected in 1989-1991. While there have been many changes since the data were collected, there are good reasons to believe that the underlying patterns identified during this period have not changed. In particular, it should be noted that despite the genocide of 1994, Rwanda has now more people in rural areas than it had in 1990. Hence, the focus of this study on how households respond to increasing land scarcity remains topical.

FINDINGS

• Land Use.

Under demographic pressure, Rwandan households are expanding cultivation at the expense of pasture and fallow and relying increasingly on four crops: bananas, beans, sweet potatoes, and maize. In most of Rwanda, these are the crops that provide highest returns to land. Moreover, increasing land scarcity is pushing Rwanda's smallholders to grow bananas in dense multi-layered associations with other crops rather than on separate fields. In most of Rwanda, banana intercropping already covers more than one-third of the cultivated fields. For the smallest quartile of farms, the share is typically above 50% on the hillsides, where erosion is a major concern.

Soil losses on fields intercropped with bananas vary greatly depending on the details of crop management practices, but are mostly well below those recorded on fields without bananas. Although the expansion of cultivation at the expense of fallow and pasture increases the exposure of Rwandan hillsides to erosion and although the reduction in fallowing contributes to degradation, the expansion of bananas helps offset the negative impacts.

The transition of Rwandan smallholders to banana intercropping only applies to the agroclimatic areas that are suitable for bananas. These areas are home to some 85 percent of Rwanda's rural households. On temperate highlands (above 2000-2100 meters), population growth is unequivocally making cropping patterns more erosive and less sustainable.

• Market participation

While beans, sweet potatoes and maize are staples grown mostly for subsistence consumption, the expansion of bananas is to a large extent a market-driven process. According to the survey, small and large farmers alike were net sellers of bananas (as such or as beer) but, per unit of land, small farmers sold more bananas than large farmers. This suggests that when farms get smaller as a result of population growth, the supply of banana beer for the market could increase, not decrease as is commonly assumed. For coffee, the reverse was true and for food crops small farmers were, on average, net buyers, while large farmers were mostly net sellers.

Net Sales per Hectare by Farm Size in Banana Zone

Kg/hectar	Farm size (ares/adult equivalent)				All Farms
	<9	9-14	14-24	>24	
Beans	-297	-102	-58	-19	-116
Peas	-8	-5	-1	1	-3
Peanuts	-4	-1	-1	1	-1
Soybeans	-4	-2	0	0	-1
Sorghum	10	25	35	30	25
Maize	-35	-7	-1	2	-10
Wheat	0	2	3	1	1
Finger Millet	0	0	0	0	0
Rice	-31	-3	-2	4	-8
Cassava	-498	-6	-27	28	-119
White Potato	-317	-49	-42	-22	-104
Sweet Potato	-214	10	64	44	-21
Taro	-42	-9	-2	7	-11
Cocoyam	0	0	0	0	0
Cooking Banana	-65	6	6	64	4
Other Banana	1218	932	937	678	935
Coffee	140	51	33	46	66

Source DSA/MINAGRI, Agricultural Survey 1990, 960 households
Banana and sorghum sales also include sales as beer

In other words, the cross-sectional patterns suggest that farmers are not responding to land scarcity simply by giving priority to food. Instead, they intensify production, among other things by intercropping bananas and food crops. As a result of this intensification, both subsistence food production and beer production for sale increase per unit of land, while both decline per household.

• **Bananas and Food Security**

Despite the waste associated with the brewing of bananas into beer, bananas provide more than one-fifth of the calories consumed in rural Rwanda. Although the most food-insecure rural households rely more on sweet potatoes and other cheaper sources of calories, the direct consumption of cooking bananas and banana beer is not unimportant for them. On average, bananas account for more than one in ten calories consumed by the poorest households. In the eastern parts of the country, cooking bananas are the principal staple food for most households.

Much of the contribution of bananas for food security comes through trade. Bananas are the single most important cash crop and second only to labor sales as a source of cash. The cash incomes from bananas are widely distributed and no more concentrated among the better-off households than incomes in general. The poorest

Cash Income Shares by Income Quartile

Per cent	Income quartile (FRw/AE)				All Farms
	<5370	5370- 8040	8040- 13120	>13120	
Net farm sales	55	64	70	64	63
Coffee	10	10	13	12	11
Banana (beer)	18	24	23	20	21
Cooking ban	0	1	1	2	1
Sorghum (beer)	7	6	6	5	6
Other crops	11	12	15	15	13
Livestock	9	13	13	10	11
Labor sales	36	31	25	29	30
Agricultural	20	15	10	4	12
Other unskilled	7	5	6	4	5
Skilled	9	11	10	21	13
Cash Gifts	4	2	2	3	3
Other cash income	5	2	3	5	4
NET CASH INCOME	100	100	100	100	100
CASH % OF TOTAL	38	40	44	49	43

Source DSA/MINAGRI, Agricultural Survey 1990, 1184 households

households use much of their cash incomes to buy food, especially beans, which are a valuable supplement to their protein-deficient diets

Our computations suggest that at the relative prices that prevailed in 1990, many land-scarce households could get more beans by growing bananas, brewing beer and exchanging beer for beans than by growing beans themselves. While the use of scarce land for beer bananas reduces food production on the farm, it can contribute to household food security by increasing the incomes and the "exchange entitlements" to food.

The argument that demographic pressure is pushing households to substitute cooking bananas for beer bananas gets no support from our data. Unlike beer bananas that have high yields and trade at very low prices, cooking bananas are a much more expensive staple, presumably because they are, in comparable conditions, considerably less productive. Indeed, since cooking bananas tend to be more susceptible to major pests than beer bananas, the yield gap is probably increasing in parts of Rwanda, pushing farmers to move from edible bananas to beer bananas. Cooking banana production has expanded in some periurban areas, but this appears to be a localized response to urban demand for a relatively costly food product, not a nationwide trend.

During the next few decades, the national importance of bananas is likely to increase gradually due to the much faster population growth rates in those parts of Rwanda where bananas grow best and where cooking bananas are a major staple. Apart from that, the future role of bananas in Rwanda's food security equation will depend

crucially on what Rwandans can afford to consume. If Rwanda's economy grows and if the benefits of the growth are shared broadly, cooking bananas and banana beer will become even more important than they are now, provided that pests or diseases do not cause drastic declines in productivity. If, however, population growth is accompanied by economic stagnation, the demand for traditional banana products will decline, eroding the economic basis of the strategy of exchanging banana beer for food. Depending on how much and how persistently poor Rwandans dislike beer bananas, they would either substitute tubers for bananas or learn to accept beer bananas as a food crop even in normal times, not just during hungry periods as has been the case until today.

IMPLICATIONS FOR POLICY AND STRATEGIC INVESTMENTS WHICH PROMOTE FOOD SECURITY AND AGRICULTURAL INTENSIFICATION

- **Prioritize bananas, sweet potatoes and beans in the development and transfer of improved agricultural technology.**

Rwanda's agriculture is increasingly dominated by three crops: bananas are the single most important crop in terms of land use and incomes, sweet potatoes are the most important source of calories, and beans dominate as a source of proteins. Together, these three crops provide more than two-thirds of calories, proteins and cropping incomes in rural Rwanda, and for the poorest households, their shares are even higher. Clearly, technical progress in these three crops is pivotal for food security in Rwanda.

The case for prioritizing the three main crops is strengthened by the fact that none of them is nearly as erosive as the main cereals, maize and sorghum. In part as a result of the relatively good crop cover and associated low nutrient losses, all three crops economize on inorganic fertilizer, which is bound to be expensive (either for farmers or for the government or its donors) in land-locked Rwanda.

Especially increases in the productivity of edible bananas would contribute greatly to food security. Banana production suffers from severe pest and disease problems and without new solutions, banana production could decline dramatically or there could be a shift from cooking bananas to beer bananas, as has already happened in parts of Tanzania and Uganda. Such a development could have dire consequences to food security and make Rwanda's agriculture less sustainable.

Experiences from other countries suggest that research and extension on bananas has a high likelihood of producing significant results at reasonable costs. Also the banana subsector equivalent of a seed industry merits consideration, since pests and diseases are often spread with infested planting materials. Private tissue culture laboratories that produce clean planting materials of bananas, coffee, and other crops already exist in neighboring countries and facilitating their emergence in Rwanda could have high payoffs.

- **Emphasize intercropping in agricultural research, extension, and policy**

As Rwanda's small farms are increasingly covered by multi-layered crop associations, most of them dominated by bananas, agricultural research and extension should be

tailored to that reality. Varietal screening, for instance, should take into consideration interactions such as shading by bananas and fruit trees. In light of the popularity of banana-coffee associations in the highlands of neighboring countries, the ban imposed on them during the colonial period should be reconsidered.

- **Enhance the contribution of bananas for soil conservation**

As banana intercropping expands on Rwandan hillsides, the development of environmentally sustainable agronomic practices for banana associations becomes a high priority. Although research on this has been minimal and only preliminary results (from Burundi) are at hand, it appears that relatively small changes in management practices could greatly reduce soil erosion in intercropped banana groves. The proposed changes may not be ready for nationwide extension, but they are sufficiently promising to warrant further research efforts.

It may also be possible to design policies that target bananas at those areas where the good vegetative cover they provide is most valuable. For instance, improved banana varieties would contribute most to soil conservation if they were targeted at the erosion-prone hillsides, where soils are often degraded and acidic and temperatures often too low for current banana varieties to do well. Soil conservation, which admittedly is only one of many factors that need to be considered, is an argument for focusing banana research and extension on the production constraints that prevail on the hills. The same argument suggests that cereal and tuber research should focus on the constraints that matter most in the valleys and flatter fields.

The principal alternative for soil conservation based on bananas and other perennials is a return to the engineering approach, probably with a strong focus on proper (“radical”) terraces. In the early 1990s, Rwanda’s National Agricultural Commission saw terraces, along with fertilizer subsidies, as the key to soil conservation and higher agricultural productivity. In contrast to intercropped bananas that have expanded spontaneously on hundreds of thousands of farms, few farmers in Rwanda have voluntarily adopted radical terraces, which require large inputs of labor to build and maintain. Except perhaps for the volcanic highlands where bananas do not grow and where potatoes are a lucrative cash crop, it is highly questionable whether radical terraces could spread significantly without massive subsidies or strong coercion.

- **Maintain high taxes on industrially produced beer.**

The exchange of banana beer for cheap staples is a corner stone of the food security strategies of hundreds of thousands of poor Rwandans, and few policy changes could do more to undermine that strategy than lower direct and indirect taxes on industrially produced beer. Beer taxes are paid by the relatively affluent drinkers of industrial beer and also transfer incomes from the drinkers of traditional beer to the producers and their employees, thereby improving the food access of the poorest rural households. They subsidize environmentally benign forms of land use and discourage the use of alcohol. In brief, lower taxes on industrially produced beer would unequivocally undermine food security and environmental sustainability in rural Rwanda. The case for keeping the taxes on industrially produced beer at a high level is strong.

- **Keep borders open to informal food imports**

Being net buyers of beans, cereals, and cassava flour, the poorest segments of Rwanda's rural population depended in the early 1990s crucially on trade policies. Since the cross-border food imports were largely informal, trade policies influenced prices not so much through the formal tariff rates but through the decisions that allowed the borders to be relatively porous so that the traders could import food from the neighboring countries, primarily Zaire. During the 1990s, eastern Zaire may have lost much of its ability to produce surpluses for export, but at the same time maize and cassava production in southern Uganda has increased notably. Open borders to the imports of basic staples and to the exports of the goods that pay for them contribute significantly to food security in rural Rwanda, and also promote environmentally sustainable land uses on the steep hillsides by lowering the prices of erosive crops (cereals and cassava).

- **Beware subsidizing erosive crops through fertilizer**

In Rwanda, highly erosive crops, such as maize, happen to be more responsive to fertilizer than less erosive crops, such as bananas and sweet potato. Therefore, it is likely that large fertilizer subsidies, especially if introduced with highly responsive cereal varieties, would increase the production of erosive crops. This is not a final word on the complex issue of fertilizer subsidies, but it is one argument for giving preference to measures that do not favor cereals over bananas, sweet potatoes, and beans.

- **Promote agricultural specialization by improving rural infrastructure.**

In Rwanda, farmers with good access to roads and hence to urban markets are more likely to produce bananas for sale and rely more on markets for beans and cereals that would give lower returns to their scarce land. This specialization increases farmers' incomes and reduces erosion on their sloping lands. Investments in rural roads and bridges would not merely allocate banana fields from previously connected but more distant areas to the newly connected areas. Also food consumption patterns would change. Urban diets in Rwanda are now strikingly different from rural ones. Urban consumers eat much less sweet potatoes and bananas than their rural counterparts, and much more cereals and white potatoes. Even controlling for income, a large gap exists, largely because bulky bananas and sweet potatoes are more expensive relative to cereals and white potatoes in urban areas than in the rural areas. This, in turn depends largely on costly transportation, which is reflected in wide marketing (gross) margins. Investments in rural roads would reduce the prices of the rural staples in urban areas, but would have little impact on the prices of beans and cereals that are imported from abroad. As a result, there would be some substitution of locally produced sweet potatoes and bananas for imported cereals in urban areas, and small shifts from the bulky staples to cereals and beans in rural areas. Since sweet potatoes and bananas have much higher yields than cereals and beans, the reallocation of land from the latter to the former would increase total food production and reduce food imports.

Since Rwanda already has good paved roads connecting prefectural capitals to Kigali, the highest priority is likely to lie in feeder roads. By neglecting feeder roads

while investing heavily in highways, policy makers in Rwanda and in donor agencies have favored food imports as well as market-oriented food production in relatively distant areas along the paved highways

- **Promote rural off-farm employment, especially during the slack season**

The poorest rural households are already highly dependent on labor sales, and as farms are getting smaller under demographic pressure, the supply of unskilled labor is increasing and putting further downward pressure on earnings. Rural underemployment and the associated food insecurity are particularly severe during the dry summer months when little productive work can be done in rainfed agriculture. Increased demand for unskilled labor is a key requirement for improved food security in rural Rwanda.

Since most rural non-agricultural activities are demand-constrained and can take off only when agricultural incomes increase, it is crucial that the direct efforts to increase employment opportunities in rural areas help rather than hurt agricultural growth. Labor-intensive public works to improve rural infrastructure are among the measures that, if well planned and executed, can both provide immediate alleviation to acute food security problems and help build the basis of sustainable agricultural growth.

Small-scale agricultural processing activities may also be worth exploring. In particular, as urban demand for cheap staple foods increases, opportunities for processing bananas and sweet potatoes into more storable and transportable dried products are expanding. Also the proposals to enhance the performance of Rwanda's banana beer subsector (Haggblade 1987) merit consideration.

The combination of technical stagnation, population growth, and environmental degradation means that only harder work can prevent food consumption from declining below subsistence levels. In the absence of technical progress the only option is often labor-based intensification, which typically involves investments in water control, soil conservation, and other low-return activities, many of which are done during periods when opportunity costs of labor are low. If better alternatives cannot be provided, government regulations should not discourage such intensification. There is some evidence that in Rwanda, the minimum wage regulations in place in 1990 may have discouraged agricultural intensification. Avoiding such policies in the future is important both for food security and for environmental sustainability.

References Haggblade, Steve (1987) Opportunities for Enhancing Performance in Rwanda's Alcoholic Beverages Subsector. Ministry of Finance, Kigali, Rwanda

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