

On the land use practices and their ecological impacts in Burundi, Central Africa

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Abstract: This field investigation in Burundi sheds some new light on the acute and conflictual interaction between the man, his culture and the natural environment in which he has to perform some economical activity for his living.

In Burundi, these problems are inherent to the traditional lifestyle of the highly dense population settled all over the country and living on agriculture and cattle rearing. Nation-wide erosion is at the end of the long and complex process of land destruction (slash and burn, bush fires, settlements, overgrazing ...).

Any solution to this situation with irreversible impacts on the ecosystem has to be holistic in order to be sustainable. It has to consider and deal with all the components of the ecosystem (the man, his culture, the nature, the economy) at the same time in order to generate balanced and constructive interactions.

1 Introduction

Burundi is a small country (27,834 km²) located just south of the equator in the high-lands of Central Africa. It stretches between 2°20'S and 4°27'S of latitude, and 28°50'E and 30°53'E of longitude (Fig. 1). Burundi is one of the most densely populated countries in Africa (5,356,000 inhabitants, 192 inh/km²). Most of its population (more than 95%) lives in the rural areas, dealing principally with agriculture.

Together with the long tradition of intensive agriculture, this population pressure on the scarce lands of this mountainous country makes people use even very marginal lands, bringing forth vegetation destruction, soil damage and tremendous ecological problems, which themselves are a serious handicap to the smooth development of this country.

This paper is a preliminary report on our findings during field works made in Burundi over a period of 8 months spanning between August 1991 and September 1993 (Aug-Sep 1991, Feb-Mar 1992,

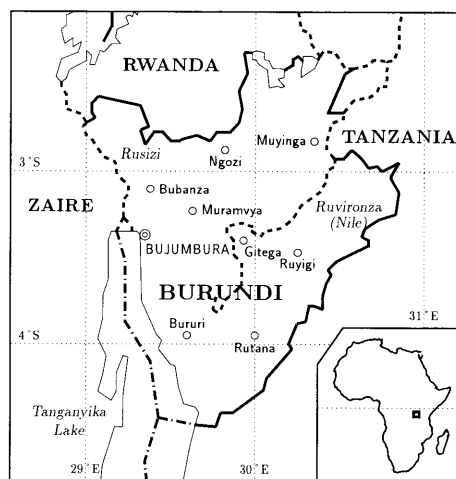


Figure. 1 Map of Burundi.

Aug-Sep 1992, Aug-Sep 1993). During this period, which covers both the dry and the rainy seasons, investigations were made all over the country and precious data collected *in situ*, from the peasants or from the IGEBU (the Burundi Geographical Insti-

tute). A more detailed report is planned for publication in a very near future.

The present report is an investigation on the land use practices in this rural country and their impacts on the environment. Special attention is paid to the socio-cultural background of the local population as well as to the international economical conditions in which people have to adopt the modern lifestyle and adapt to it.

2 The country and its natural constraints

Notwithstanding its tiny area, Burundi presents a lot of natural environments (ecosystems), each one characterized by a typical landscape, climate, pluviometry and vegetation. The most distinctive dividing element is the altitude, which parts the country into hot plains, cool plateaux, temperate slopes and cold mountain areas. Another dividing element is the Zaire-Nile separation line running all the way from North to South along the eastern bank of the Tanganyika lake, with the highest mountains of the country (Mount Heha peaks at 2670 m).

The cross-section of Burundi (Fig. 2) shows from West to East, the Tanganyika lake (20~65 km wide, 650 km long, 31,900 km²) deep in the Rift Valley with its adjacent plain (Imbo), the western slopes (Mirwa), the Crest Zaire-Nile, the central plateaux and the eastern depressions (Kumoso).

Each one of these regions constitutes a typical ecosystem with a given degree of fragility,

which should be considered when land is developed through human activities.

2.1 The Imbo Plain

This plain stretches from North to South along the Rusizi River and the Lake which is at 774 m of altitude. It is characterized by little daily nebulosity, therefore high insolation (2100~4400 h/year), the highest temperatures in the country (24°C) and reduced rains. The dry season runs from May to October. Rainy seasons are erratic, droughts are frequent and imprevisible.

The soils in the Imbo especially in the northern part have a high salt concentration, which is toxic to many bacteria, making of this area improper for agriculture. Soils are compact, ill-ventilated and impermeable due to the dispersion of clay by the too-abundant Na⁺ ion.

The natural vegetation here is savanna woodlands, with many palm trees, especially in the South, near Rumonge and Nyanza-Lac.

2.2 The Mirwa

These slopes close the Imbo plain to the East. They are wetted by high pluviometry and blown by strong winds (land breeze at night and lake breeze in daytime) all year long. The dry season is short (3 months at maximum). The natural vegetation of this area is shown by some relics of original dense forests (nowadays nearly not existant) which are mostly replaced by savanna structures.

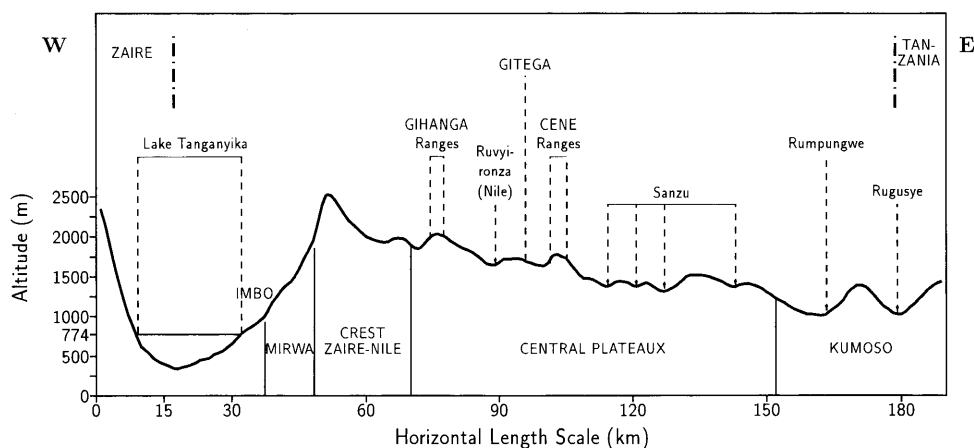


Figure. 2 Topographic cross-section of Burundi along the Bujumbura-Gitega line. (adapted from Bidou et al., 1991).

Erosion due to the heavy rains over this densely populated slopy area is a very challenging problem against which both the peasants, the ecologists and the government are fighting a lost fight.

2.3 The Crest Zaire-Nile

This area constitutes 20% of the country and peaks over 2600 m, with a very mild, even cold, climate and plenty of rains (3 to 4 months of dry season). Fogs are very frequent in the mornings, while afternoons are overcast, giving place to reduced insolation (4 h a day at Rwegura). In the valleys, temperatures can go down to 0°C at night.

Here is the realm of the dense tropical forests, with maximum development between 1950 and 2250 m and characterized by high trees, dense bushes and vines. Soils are rich, with topsoils up to 20 cm deep, where the roots of towering trees fetch for nutrients.

However, only parts of the primary forests remain. Most of the existing forests are secondary ones, regenerated after some actions by the human (shifting cultivation, bush fire ...).

2.4 The Central Plateaux

Ranging from 1700 to 2000 m, these plateaux cover more than 50% of Burundi with monotonous hills. Mean temperatures are between 16 and 19°C and rainfalls go from 1200 mm in the East to 1400 mm in the West, over 8 to 9 months of rainy season.

High population density is typical (more than 180inh/km², and sometimes over 300inh/km²). Therefore, the natural vegetation (tropical dry forests) has almost disappeared, except for some highlands in the East. Savanna woodlands or acacia forests prevail. In the valleys, where the topsoils from the slopes accumulate, swamps are drained and cleared of their original cores of papyrus to form rich agricultural lands, good for cultivation during dry seasons.

2.5 The Kumoso depressions

This region, of around 1300 m of altitude along the boundary with Tanzania, is characterized by mean temperatures of 20~21°C and 1100 mm of rains over 5~6 months of rainy season. Here, dry

seasons are as long as in the Imbo, but less severe, and rains less erratic.

Tropical dry forests are the natural vegetation found here. But they are severely reduced to the valleys along rivers due to the frequent bush fires set by the pastors annually and the pressure for new agricultural lands by endless waves of immigrants. Savanna woodlands can be found now everywhere, instead.

3 The climate

As for many other African regions in the same latitudes, Burundi witnesses a 4-season pluviometry regime, marked by two maxima and two minima of unequal lengths. Daily agricultural activities of the rural people are adjusted to fairly fit to this annual cycle.

3.1 The little rainy season (*agatasi*)

The first rains fall by mid-September, but they are irregular and not so abundant until mid-October, when heavy rains pour down until December, bringing forth nearly 30% of the annual rainfalls.

During this period, people plant corn, beans, peanuts ... to be harvested in December or January.

3.2 The little dry season (*umukubezi*)

This period (January-February) is dry in the lowlands (Imbo, Kumoso), but with reduced rains in the Mirwa, the Crest and the Central Plateaux. People harvest, dry and stock the products.

This season is not rendered out in the long term means of precipitations, which show a long rainy season from October to April. But, it is well known to the peasants.

3.3 The big rainy season (*urushana*)

Extending from mid-February to May, this season being more than 50% of the *annual* rains. Rains are nearly daily until April, and get less frequent in May. However, they are characterized by heavy showers, followed by clear skies, which allow the ripening of the crops grown during the season.

3.4 The big dry season (*ici*)

It is observed all over the country (from 3 to 6

months); very little rains fall in June and August, while July is totally dry. The soil gets dry and dusty. This is the period of rampant bush fires. Preparations for fields (slash and burn ...) are made for the following little rainy season. Plants grown during urushana are harvested and stocked.

4 Land use practices

In his search for a better living, the human being has since immemorial times, interacted with the surrounding environment for his settlement (housing, city building), agriculture or cattle rearing, bringing sometimes the soils to the limits of their life sustaining capacity. Burundi is a living case study of these excessive interactions as can be seen in the following.

4.1 The settlement

Most of Burundi population live in the countryside, scattered everywhere over hills. The occupancy rate reaches 75% of the lands in the densely populated areas, such as the Buyenzi region of the central Plateaux (300 inh/km²). Each family exploits a small plot of land — very often a hill — where they build huts (*ruغو*) surrounded by banana plantations, maize, beans or peanuts fields, fallows or natural pastures on the slopes towards the valley. The rich lands in the valleys are excessively parcelled out among the owners of adjacent hills. The mean area per plot (family) is steadily decreasing due to the high population growth rate. Ntamobwa (1987) notes that, more than often, this compels people to emigrate to other less populated regions of the country, such as the Kumoso, or in the cities (such as Bujumbura) to work as salaried workers.

This traditional settlement exerts a huge ecological pressure over nearly all the national land at once. We think this to be the fundamental socio-cultural cause of environment disruption in Burundi. In fact, from it depend both the agriculture and pastoring systems to be adopted by the rural peasants.

4.2 Rural agriculture

The rural farm is centered around the *ruغو*, the exploitation center. Just around it, are omnipresent

banana plantations where the soil is fertilized with domestic leftover and wastes. Around these plantations, we find plots of reduced sizes and various forms where various agricultural products (maize, beans, peanuts, coffee, vegetables ...) are grown according to the local ecoclimate. Very often, mixed cultivation among two, three or more crops is wisely practiced, according to their respective sensibility to the irregularity of climate and the phytosanitary diseases. Farther from the *ruغو*, we find the fallows and the natural pastures for the cows and other domestic animals.

With the population increase, fallow and pasture lands are the first to be sacrificed in order to provide new agricultural lands. In many cases, the farm land is divided among the male children of the owner after his passing away, reducing even more the exploitation area per family. Bidou et al. (1991) point that in some areas, plots of less than 50 ares are not rare (23 ares in Ngozi; 20 ares in Gitega).

The most used instrument is the hoe, locally produced by the village smith in the former time, but now bought at the market. Other instruments such as knives, pruning knives, axes ... are still produced traditionally. The mechanization of agricultural activities is almost inexistant, except for some state-owned cooperatives scattered over the country.

The agricultural year is set to fit the annual pluviometry cycle. Burundi people had traditionally two agricultural seasons: the *agatasi* (sowing in September and harvesting in January) and *impeshi* (sowing in February and harvesting in June). Recently, as the valleys and marshlands have come to be exploited, a third agricultural season during the dry season by irrigating these lowlands (June-September) has been created. Thus, with 3 seasons of 4 months each, there is virtually no "*morte-saison*" in the agricultural year in Burundi.

4.3 The cattle

Cattle rearing has always been an important activity in the Burundi society. In former times, only the King, who had the largest herds, could give cows as a present to his men, or even confiscate some of them, as he pleased.

The economical value of the cow was not —

and is still not — for its meat to be sold for money, but for its milk (for the people) and its dungs for the land. It was thus a social symbol of wealth, and was used as a token in sealing new relationships (friendship, marriage ...) among people (Bahenduzi and Guillet, 1987).

Recently, people have started to shift more and more toward rearing sheep, goats or pigs, because of the adaptability of these cattle to the small size of the rural farms. However, the economical role of cattle rearing is still lacking, especially in the traditional rural areas.

In the average, mean consumptions of 14 liters of milk and 3 kg of meat per year per person has been recorded in 1990, which is obviously not enough!

The geographical distribution of bovine herds is deeply depending on the availability of pasture lands as well as the eco-climatological conditions such as temperature, rainfalls and the presence of phytosanitary diseases. In general, most of the herds (25 ~45 heads/km²) are reared in the highlands in the South and the Center of Burundi (Bururi, Muramvya, Kayanza, Gitega, Ngozi) between 1200 and 1800 m of altitude. Contrary to the Southern part which is still less populated, the Central Plateaux (Gitega, Ngozi ...) have the highest population density and land use for settlement and agriculture is at its maximum, implying a net diminution in cattle rearing activities.

The Mirwa watersheds, with advanced erosion and high density of population, have less than 20 heads/km². The lowlands of Imbo and Kumoso, which are less populated, have still little herds (less than 25 heads/km²) notwithstanding their relatively huge land availability. However, paludism (for herdsmen) and trypanosomiasis (for herds) seem to be the biggest handicaps in order to make these regions fit to cattle rearing.

Due to this ill-distribution of herds versus pasture lands, transhumance between the highlands and the lowlands, especially in the dry season, is a common practice (Photo 1). Add to it the traditional bush fires set to the savanna by the end of the dry season in order to accelerate the sprouting of young green grasses for the herds, and the fact that 90% of

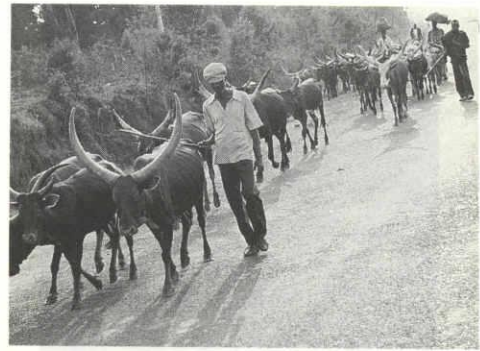


Photo. 1 Transhumance from the Plateaux to the lowlands.

energy used in Burundi is still provided by fuel woods, than you can have an image of the problem!

5 Ecological impacts

Put altogether, the geographic and socio-ecological conditions in Burundi (hilly landscape, climate, demographic distribution, lifestyle) create a huge pressure on the fragile Burundi ecosystem. The effects of this pressure are mostly shown up in the form of widespread erosion, which in some places is tremendous.

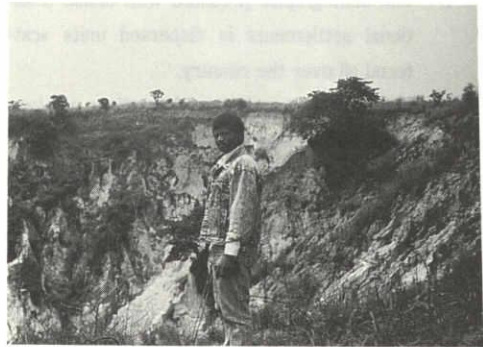


Photo. 2 Erosion and landslides are all over the country. Local people believe such places to be haunted by bad spirits.

Erosion is impressive and nationwide. It is manifested in subtle ways such as the generalized savannization of the landscape or in more aggressive forms such as landslides (Photo 2) or scarce and degenerated vegetation over large areas, especially on the slopes or the tops of mountains, where red laterite soils prevail (Photo 3).

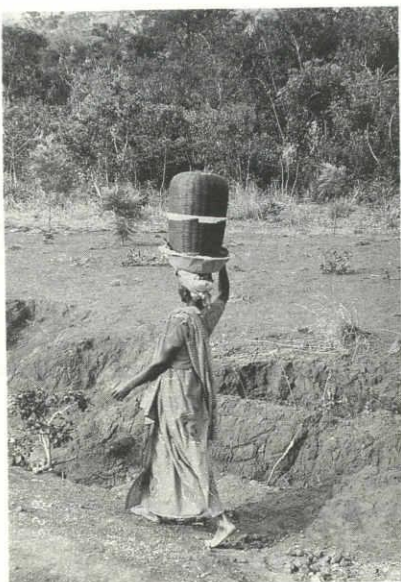


Photo. 3 The thin topsoil is washed away by heavy rains, leaving wide zones of non-fertile red laterite soils.

This ecological problem is exacerbated by the following factors principally:

1. The demographic pressure with dense traditional settlements in dispersed units scattered all over the country.
2. The traditional agricultural practices on slopy lands soaked by heavy rains.
3. The overgrazing by huge herds in the most densely populated areas, which eat out the scarce vegetation cover over the hills and mountains.
4. The traditional practice of slash and burn cultivation and annual bush fires.

It was noted above that traditional settlement in Burundi was not of village-type, but of dispersed-type, with a high density of land occupancy. Panabel (1987) notes a vicinity range (=distance between two neighboring *rugos*) varying between 50 m (in the densely populated regions of Ngozi and Muramvya) to 325 m (in Bururi, in the South), with 4–6 persons per *ruغو*. New land appropriations can be made only (1) by dividing the lands already in use by the former owner or (2) by using very

marginal lands on very steep slopes or in nearly nonaccessible valleys, or (3) by reducing or even suppressing fallows and pasture lands.

Agricultural activities start by hoeing off the natural vegetation cover before ploughing the land. This operation has the big disadvantage of naking the slopy lands, making them very vulnerable to the streams of heavy rains, especially at the beginning of the rainy season.

Moreover, traditional ploughing is done by making mounds along the slope lines from the bottom to higher altitudes (=creeping), creating thus ideal running off channels for the rain waters between the mounds.

More than often, the relics of forests are cut down for slash and burn cultivation, and the fire used to clear the land instead of hoeing of the weeds. Besides the destruction of the vegetation cover, this practice renders the soil very hard and improper to the infiltration of rain waters, increasing thus their runoff along the slopes, and the erosion as well.

Overgrazing by huge herds over scarce pasture lands contributes to the destruction of the vegetation cover, as well. The cattle eats out grasses and even their roots when there is not enough vegetation. Also, pounding the ground with their sharp clogs, the animals add to this destruction activity, as can be seen by the denudated lands along their path or near their drinking points (Nsabimana, 1987).

Bush fire is another problem worth speaking

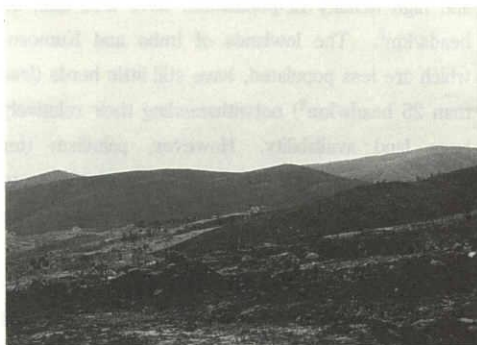


Photo. 4 Hills burned by the traditional bush fires in the Kumoso: immense savanna regions and reforested lands are burnt like this every year.

Table 1 : Bush fires in Burundi (September 1992)

Province	Types	Traditional or criminal (ha)	Accidental (ha)	Unkown (ha)	Total (ha)
1. Cankuzo	Savanna wood lands	837	82	188	1007
2. Ruyigi	Savanna + reforested lands	6268	182	—	6450
3. Rutana	Savanna + reforested lands	422	3	—	425
4. Cibitoke	Reforested lands + natural forests	—	35	223	258
5. Bururi	Reforested lands + natural forests	1360	—	—	1360
6. Bujumbura	Savanna wood lands	16	6	—	22
7. Makamba	Savanna wood lands	—	10	—	10
		8903	318	411	9632

about in Burundi. People (both farmers and pastors) use to set fire to the hills in order to clear the lands for agriculture or to accelerate the sprouting out of new grasses for the herds by the end of the dry season (Photo 4). Recently, bush fires have become a nationwide problem every year by August-September. For example, in 1992 alone, we observed the burning of nearly 10,000 ha of reforested lands by traditional bush fires (Sanga, 1993, Table 1). This is repeated every year, changing into smokes millions of dollars of international official aid to the government of Burundi.

Put together, all these traditional practices denude the already fragile soils and make them easily destroyed by the running off of rain waters, giving place to irreversible erosion on nationwide scale (Photo 2). The future of Burundi, which is typically an agricultural country, depends on how the nation can fight against erosion in order to survive.

6 Discussion and concluding remarks

Through this field work and investigation, it has become clear that all the traditional lifestyle in Burundi leads inexorably to the intensive destruction of the vegetation cover and, therefore, the soils (Kadomura *et al.*, 1989). And this, notwithstanding the remarkable efforts by the state in terms of the protection of the environment (National Parks, protected forests) or the reforestation for marginal lands in the framework of ODA (Official Development Aid). Bidou *et al.* (1991) note that less than 3% of Burundi are covered with forests, while by 1987, a total of nearly 45,000 ha was planted.

It is obvious that some rigorous actions should

be done, and now, in order to stop the prevasive erosion which heralds agricultural improductivity and risks of famine in a very near future.

First of all, an appropriate type of settlement should be devised, for example by concentrating peoples into villages. This will make more lands available for agriculture and avoid settlement of human on marginal lands. Modernization of the housing and agriculture can also be foreseen within this perspective.

The Burundi population is heavily illiterate (literacy rate around 46% for man and 35% for women). A nationwide literacy campaign implying agricultural education and environment management should be taken to teach the local people how to fight erosion over their lands (building anti-erosion fences, tree planting, tillage along the height contour lines and not along the slopes, terraced fields, irrigation ...).

Peasants should be changed from the present time status of environment destroyers, into permanent protectors of the national land assets. In this way, the state should concentrate more time explaining to the peasants why some of their hills or mountains would be reforested. Indeed, for most of them, reforestation by the state is a kind of loss — and it is huge in this country — of traditional agricultural or pasture lands. In this perspective, the state forests are seen as something to get rid of in order to recover their traditional rights, anyhow. Table 1 shows that nearly 94% of fires recorded in 1992 occurred due principally to this traditional way of thinking.

Any solution to this complex socio-cultural

problem with irreverible impacts on the ecosystem has to be hollistic in order to be really sustainable. It should consider at the same time both the man and the natural, cultural and economical environments in which he is embedded. And Burundi is not the only one African country in this kind.

Acknowledgement

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