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AGRARIAN DYNAMICS, POPULATION GROWTH AND RESOURCE MANAGEMENT: THE CASE OF BURUNDI

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Abstract

What role has intense population pressure played (and continues to play) in ancient and contemporary transformations in Burundian agriculture? A considerable disincentive to development and source of imbalance for some, engine of agricultural growth for others: does this age-old debate still make sense in the present context? Based on a comprehensive study of agrarian dynamics, the reconstruction of different agrarian systems that have been in place over time, and an investigation of the major transformations that have led to the transition of one system to another, the author ventures a rereading of the most commonly cited interpretations of Malthus and Boserup. The author draws attention to the originality and complexity of these transformations as well as the conditions that both enabled and constrained them.

Key words

Africa, Burundi, history of agriculture, agrarian systems, peasant innovations, demographic pressure.

Introduction

The countryside of the Central African Highlands (Rwanda and Burundi) is characterized by a humid and tropical climate tempered by altitudes of 1000 to 2000 meters, low rates of urbanization, dispersed habitats, small peasant landholdings (generally less than 1 hectare per family), field patterns composed of very small joining plots, double cropping, manual self-subsistence farming and little marketed surplus.

In this context of very strong land pressure, population growth has become of utmost concern to researchers, development actors and government authorities. Population density jumped from

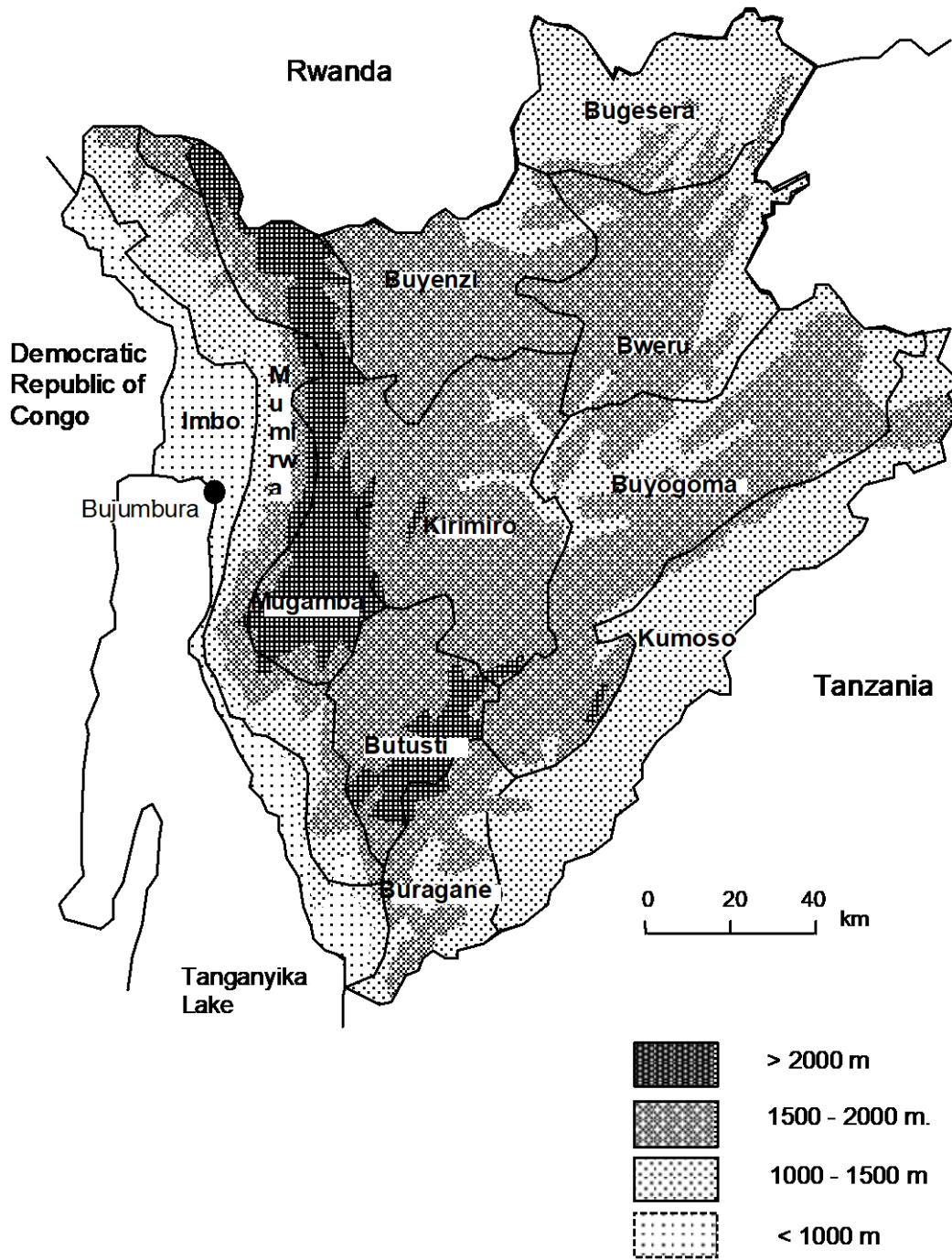
some 100 inhabitants/km² in 1960 to 192 inhabitants/km² in 1990¹ and has continued to increase in recent years. Figures refer to rural population density, almost exclusively agricultural, since urban centers account for only a very small proportion of the country's population (5 % in 1979, 6% to 7% in 1990).

The evolution of Burundian agriculture is most often explained by the following model². The population explosion provoked a considerable increase in land pressure which led to an expansion of cultivated areas at the expense of grazing and fallow lands. This has resulted in a decline of animal husbandry, the reduction of average surface area per landholding, cultivation of sloping lands, worsening erosion, an overall decrease in soil fertility and yields, and a situation of widespread under-employment in the countryside. Since agricultural techniques have essentially remained unchanged, it would appear that the population explosion has incited a "population/resource imbalance" that is at the root of present problems.

In this interpretation of recent transformations in Burundian agriculture and, incidentally, in many other African regions, the man vs. land relationship is the main variable and population growth is seen as the root of all evil in the agriculture sector. Another obstacle to agricultural development is also emphasized: the traditionalist mentality of farmers, judged as such based on their reticence to use so-called modern techniques proposed by extension services, and their deliberate desire to produce only enough to meet their immediate needs, a "self-subsistence reflex" that severely limits the amount of surplus available for commercialization.

However, the reality is far more complex. The role of demographic pressure in the transformation process of farming practices must be rethought. Based on an extensive analysis of ancient and contemporary transformations of agrarian systems, this article proposes an original analysis of the demographic pressure/agricultural growth/resource management relationship as it applies to intensive, manual farming in the mountainous regions of Central Africa.

Figure 1: Map of Burundi and its Natural Regions



Source : H. Cochet

Concepts and Method

Farming practices and agrarian transformations are among an ensemble of elements that make up an *agrarian system*, a fundamental concept to the Comparative Agricultural approach used here.³ The concept of agrarian system aims to apprehend the state, the workings and the reproductive conditions of a society's agriculture sector at a given moment in history. The concept embodies both the operating and reproduction modes of one or several ecosystems, the social relationships of production and exchange that have contributed to the sector's creation and development, and the economic and social conditions of the ensemble, particularly the pricing system that dictates entry into international markets. A notion first developed by French geographers, very much centered on "agrarian structures" and their spatial expression in the agrarian landscape,⁴ the agrarian system concept was subsequently elaborated upon by agronomist M. Mazoyer starting in 1975.⁵

From the very concept of system stems the notion of balance and "reproducibility", or sustainability, as we would say today. For this reason, the mechanisms that maintain and reproduce the conditions necessary for an ecosystem to function (such as soil fertility recovery, management of material and human resources, the stability of dominant social relationships) are an integral part of the agrarian system and its definition.

The study of a reality as complex as that of a society's agricultural sector also requires one to resort to concepts in which efficiency and relevance are measured on different scales.

Hence the concept of *cropping system*. This concept applies not to a crop but to a plot of land (or a group of plots) cultivated in a particular way by the farmer. The "system" refers to the crop or crops that are planted (and their possible mix), crop sequencing and the ensemble of techniques that are applied to them, in what order (*crop management sequence*) and under what soil and climate conditions.⁶ One considers, for example, that the mixed cropping of maize and beans in the first cultivation season, followed by a cycle of sorghum during the second season constitutes, if the same sequence is repeated each year in the same place, a *cropping system*. It would be noted as follows: maize+bean/sorghum.

On a comparable analytical level, *livestock system* is a concept that helps apprehend livestock rearing, involving aspects such as the herd's composition, its feeding habits, corresponding forage calendar as well as animal husbandry (migration, reproduction, care, etc.).⁷

The *farming system* concept is relevant for carrying out analysis at the intermediate level⁸ of the production unit. It looks at specific combinations of different cropping systems and, where relevant, the different livestock systems used by the farmer depending on production means and labor power available. It is at this level of analysis where measuring the economic efficiency of production processes is the most interesting, be it calculated with relation to the labor power used (in which case one would address the basic problem of labor productivity) or with relation to the land surface occupied. Cropping systems and livestock systems are therefore sub-systems to the farming system and must be analyzed as such. The use of the farming system concept in the study of African agriculture has led to long debates, and extensive publications, thus revealing the diverse and complex facets of the African household unit.⁹ Nevertheless, the farming system concept is useful for capturing the complexity of agricultural production units in Burundi, since extended families and polygamy do not modify the essence of the production unit, which is centered on the nuclear family.

The historical reconstruction to be presented in the first section of this article is based not only on a critical re-reading of historiographic sources available, but also on field work carried out in the country from 1990 to 1995.¹⁰ In effort to apprehend the most significant former farming practices, the author carried out an analysis of the landscape and numerous interviews with aging farmers. Based on this data, attempts were made to (i) reconstitute and then reconstruct the cropping and livestock systems used at different times throughout history, (ii) reconstruct the farming systems currently used and finally (iii) sketch a portrait of the agrarian system as a whole.¹¹ This intellectual construction is built upon an ensemble of concrete elements fixed in both time and space as well as upon a series of specific concepts. The objective is to establish a correlation between the elements (defined beforehand and situated as precisely as possible in both space and time) and to identify consistencies within the ensemble that will serve to carry out analysis over time.

This approach of reconstructing and modeling the agrarian systems that have succeeded each other over time in Burundi allows us to examine in a new light the age-old debate of population growth and agrarian transformations that divided the neo-Malthusians and followers of E. Boserup in the 1960s.

Three successive agrarian systems

Three agrarian systems have succeeded each other in Burundi over the course of two major agricultural revolutions that involved complex and simultaneous transformations that were far-reaching enough to lead to the shift of one system to another. One can identify thus a total of two agricultural revolutions and three agrarian systems, if we suffice ourselves with what has happened since deforestation and the spread of high altitude grassland ecosystems one or two thousand years ago.

The historical relationship of farming and animal husbandry

Reconstituting the Burundian agrarian system before the introduction of American plants such as maize and beans (*Phaseolus*) in the 17-18th centuries enables us to deduce that sorghum and eleusine (or finger millet) (*Eleusine coracana*) constituted the staple diet of Burundians, complemented by *vigna*-type beans (*Vigna unguiculata*), pigeon peas (*Cajanus cajan*), voandzou, certain kinds of yams, (*Dioscorea bulbifera*, in particular), taro (*Colocasia antiquorum*), a type of coleus potato (*Coleus dysentericus*), several varieties of squashes and a few leaf vegetables (African eggplant, bitter spinach, New Zealand spinach [*Tetragonia tetragoniodes*])¹². The cropping systems were overwhelmingly dominated by the two grains (sorghum and eleusine), fertilized using cow dung collected each morning from the enclosed compound (*ruغو*) where the livestock spent the night. Beyond the cultivated lands (situated near the compound) were extensive pastures where cattle grazed. Milk and butter (the latter was used in cosmetics as well as for tempering *figus* bark which was used to make fabric) were thus a part of the basic diet of Burundians. Animals were lead to the pastures each morning by a herder and brought back in the evening to spend the night in the pen. One can conclude, then, that since this period and probably even much earlier, half of all dung (that released during the night) was retrieved, thanks to nocturnal folding. Dung collection and its spread over cultivated lands constituted the two phases of lateral fertility transfer which benefited the crops and ensured the sustainability of the system.

The agricultural revolution of the 18th century

Starting in the early 18th century, a veritable agricultural revolution occurred, disrupting this ancient system and leading to significant progress, considering the period. Upon first glance, the most noticeable new feature was of the widespread introduction of plants of American origin (maize and *phaseolus*-type beans) in the cropping pattern and mixed cropping¹³. However, the

progressive generalization of double cropping—two cycles of culture per year—and the noted improvements in the farming-animal husbandry relationship proved to be the most fundamental changes.

Figure 2: Rainfall and cropping seasons in Burundi

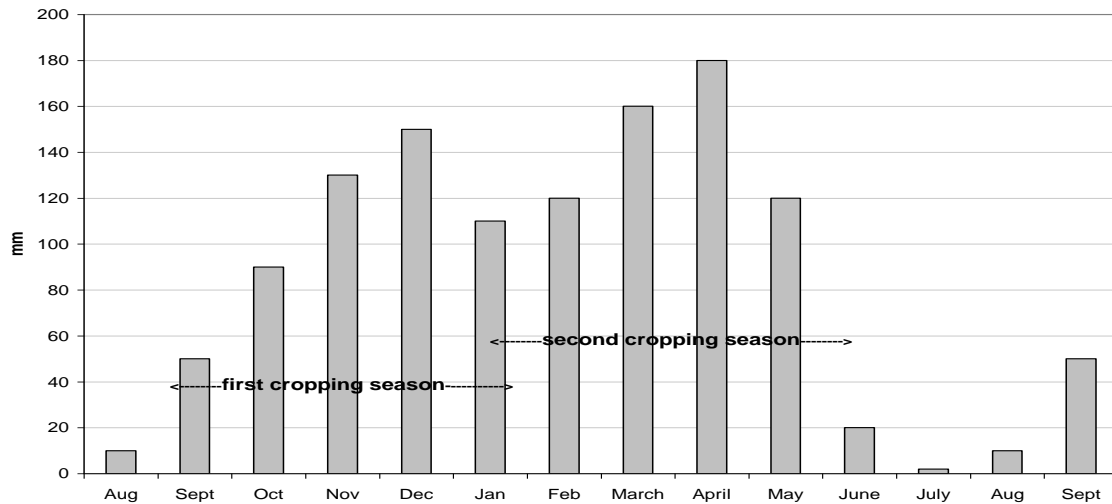


Figure 3 : Most common cropping systems in the agrarian history of Burundi

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Most common cropping systems before the introduction of American plants														
Fing. millet	←-----→													
Sorghum*	←-----→													
Most common mixed cropping system after the agricultural revolution of 18 th century														
Maize	←-----→													
Phaseolus	←-----→													
Sorghum	←-----→													
Example of mixed cropping system today (not including banana groves)														
Maize	←-----→													
Phaseolus	←-----→													
Sorghum	←-----→													
Sweet pot.	←-----→													
Cassava	←-----→													

* Finger millet and sorghum were planted, in this case, separately.

In ancient farming (before the spread of American plants in cropping systems), sorghum was planted at the start of the rainy season, something that seemed very natural,¹⁴ and harvested at the end of the rainy season. The same processes held for eleusine. Planting and harvesting two crops cycles per year on the same plot was made possible by the short vegetation cycle of beans and maize: around three months for former and five months for the latter. It appears that the modern agriculture calendar used today by all Burundian farmers was established during this period. It is composed of three seasons: the first corresponds to the first part of the rainy season (September to December), the second corresponds to the second half of the rainy season

(February-June) and the third corresponds to the dry season during which time the wetlands are now intensively cultivated (July-September).

Thus, a shift took place and beans and maize were planted, in association and at the same time, following the October rains. Harvested in December, beans made place for sorghum, which was broadcast sowed among the maize plants. After the maize harvest that took place during the “little dry season” (January-February) and before the renewed rains, the sorghum was alone on the plot, to be harvested when the dry season was completely over, in July. The plot was thus planted two times successively during the same year. Despite a few regional variations, the combination of crops maize+beans/sorghum became the most common across the country¹⁵.

The widespread introduction of maize and beans intensely modified the work calendar of the peasants. The change to the sorghum cycle (seeding was delayed until December) created a new period of intense farming during the months November-December, owing to the bean harvest and sorghum seeding. February brought another heavy work period, with the maize harvest and probably the simultaneous hoeing of the sorghum. With April came a second hoeing of sorghum, while the eleusine harvest extended from March to May, depending on the variety and region. With the sorghum harvest during the month of July, a new period of activity would begin.

At the cost of an overall increase in work, farmers were thus able to practice two crop cycles per year since the intense labor periods for each crop did not coincide. Overall labor productivity as well as productivity per worker increased considerably, even though productivity per hour or per day remained unchanged, since the tools being used were exactly the same as they had always been.¹⁶

But the progressive spread of the double crop cycle taxed the soil's mineral reserves more intensely, forcing farmers to develop more efficient fertility renewal mechanisms. The increase in livestock alone was not enough to satisfy the need for the manure to be spread on the cultivated plots (which had themselves increased in size due to population growth). Furthermore, the resource—in this case cow dung—was used in higher concentration on the plots where the new double crop cycle was applied, due to the system being more intensive, as well as to the fact that the plots were closer to the holding pen. As a result, the distant eleusine plots were deprived¹⁷. The accumulation of cattle, and especially dung, thus became central to peasant strategies and the social relationships that developed around the distribution of live capital.

As the one of the only goods subject to accumulation (apart from hoes), livestock represented both capital and the most efficient tool for transferring and renewing fertility on the double-cropped plots. Animals were therefore at the base of increased productivity: without cow dung, double cropping was not possible. The prestige that came with being the owner of a large herd stemmed from the additional labor power the owner inevitably had access to due to the dominating power relationship that was established with those who had little or no livestock, obliged to exchange their labor for dung. Situated at the center of social relations and an engine of social differentiation, possessing livestock and dung gave way to a variety of other work arrangements as well. For example, people who did not own animals could have access to them via *ubugabire* contracts in which an owner would entrust a cow to the animal-less farmer.¹⁸ Although not the owner in his own right, the farmer could take advantage of the manure generated by the animal, taking it from pasture areas to fertilize plots.

Distribution of cow manure was therefore more egalitarian than livestock ownership under the ancient *ubugabire* system, enabling effective fertilization for the majority of landholdings at that time.¹⁹ It was as if the social relationships, as inequalitarian as they might appear, permitted the spread of the farming-animal husbandry relationship regardless of the inequalities that existed in bovine ownership. Indeed, the widespread practice of double cropping, the interweaving of new work calendars and the doubling of productivity that resulted would not have been possible without the widespread practice of animal husbandry (and not necessarily the ownership of animals). The redistribution and management of cow dung was at the center of this process.

There is no doubt that the introduction and development of American maize and beans produced important agrarian changes, even if the process, the rhythm and the modalities of dissemination, experimentation and definitive adoption of these new crops are not yet clear. Likewise, there is no doubt that the generalization of these “first season crops” (maize and beans), as they became known, had a significant impact on people’s work schedules, the amount of labor done in the fields, the number of harvests, overall productivity, the composition of people’s diet and the resulting relative food security. The population growth experienced in this part of the world in the 18th and 19th centuries²⁰ must be considered in relationship to these decisive evolutions in agricultural production and the population’s living conditions. First population estimates put demographic density at 55 inhabitants/km² at the beginning of the 20th century (58 inhabitants/km² for Rwanda).²¹ This figure is probably low, since it was estimated

after the population crisis that took place during the last decades of the 19th century (see below). The demographic density of the Kingdom of Burundi at the end of the 19th century was thus exceptionally high in comparison to the rest of the African continent.

A Malthusian crisis

Towards the end of the 19th century, this intensification process was brutally interrupted and the country entered into a serious crisis that lasted several decades: between 1891 and 1905, rinderpest, foot and mouth disease and trypanosomiasis led to a severe decrease in the number of livestock.²² Food shortage struck the country while famines broke out in the regions most affected.

Looking back on this problematic period, the rinderpest appears to have played a decisive role. As bovines were the principal form of capital accumulation for farmers, the pest led to severe decapitalization on most farms. Moreover, as the principle vector of fertilization of arable lands, the disappearance and/or drastic reduction of cow dung must have led to a drop in yields. The other epidemics thus evolved in very conducive conditions because the majority of the population was already badly nourished and had low resistance. This probably explains the intensity of this “microbial reaction,” despite the fact that the majority of the microbes had been present in the region for many years.²³ The trypanosomiasis epidemic, triggered about twelve years after rinderpest and smallpox, seemed itself the result of an ecological imbalance caused by the two preceding pests and the return of arable lands to abandoned pastures.²⁴

Yet, considering the total surface area, plots and pastures needed for a farming family of five to live (a minimum of roughly twelve hectares²⁵), it is possible to estimate that the maximum demographic density authorized by this agrarian system was about 50 inhabitants/km², a ceiling perhaps a bit high if we deduct from the surface area the high altitude forest of *Kibira* and the rocky crests and summits that are not conducive to planting or grazing. As sophisticated as the new system appeared in comparison to preceding ones, it could not nourish more people. And it is precisely the density level that was reached and even exceeded at the end of the 19th century. With the system left unchanged, any additional population growth necessarily led to a decrease in cultivated surface area for each family and/or the reduction of grazing lands of which a part would be once again used for cultivation. The author’s hypothesis is that the inevitable erosion of the pasture/fertilized lands ratio brought on widespread overgrazing. The livestock suffered from

increasingly poor nourishment and were struck fatally by the pest, the quantity of animal manure decreased, leading to a drop in both productivity and crop yields.

While much more efficient than the system that had preceded it, the two-crop per season agrarian system that was born of the agricultural revolution of the 18th century did not require less space owing to the crop-livestock relationship. It fell victim to its own efficiency and capacity to feed more people. Also victim to the population growth that helped make it possible to reach (in accordance with the Kingdom's territorial expansion) the frontiers of the highlands that were so favorable to its development, the agrarian system ultimately suffered from the overpopulation of people and animals, to the point where its physical limits were finally reached and surpassed.

It was indeed the crisis of this agrarian system, both revealed and triggered by the bovine pest at the end of the century that led to fifty years of hardship and population stagnation that lasted until the mid-1940's. While unaware of the deeply embedded causes of the crisis and what triggered it, colonization and forced entry into the market system under bad circumstances ultimately prolonged the crisis far beyond what would have been otherwise possible. And while the elements of a totally new agrarian system were already falling into place at the turn of the century, the crisis is not truly resolved until the 1950's.

Banana cultivation and mixed cropping: towards labor-intensive polyculture gardening

After showing signs of timid growth in the 1920's, the demographic curve took off in the 1950's-60's. As a result, current population density (essentially rural—Burundi has seen very little urbanization) is close to 200 inhabitants/km², three times greater than the capacity of the pre-colonial agrarian system. Population explosion is, of course, typical in a developing country that has managed its first demographic transition. What is notable however is that the country has, for the most part, achieved food self-sufficiency. Food production has kept up with population growth, putting Burundi on the very short list of African countries that are self-sufficient (or was, at least until the beginning of the civil war that has ravaged the country since 1993²⁶).

While production means have not evolved and the expansion of cultivated lands to the detriment of grazing lands was ultimately limited (cultivated lands increased about 50% from 1950 to 1990²⁷), food production has increased by 150%, i.e., three times more than cultivated lands²⁸. This remarkable dynamic is the result of a progressive and continual intensification of cropping

systems in which the two main components were (i) the multiplication of crop cycles and the spread of mixed cropping (with the progressive disappearance of interspersed fallow periods) and (ii) the cultivation of bananas.

By the 1950's, the basic components of this new agrarian dynamic could already be seen on the majority of farms situated in the hills of the central plateau. Indeed from this period onwards, farmers engaged in a variety of different cropping systems on the same landholding, each one quite different from the other. The most intensive and best fertilized systems were situated closest to the family's compound (*ruogo*). And while a strict circular ("aureole") layout was not always the case, one would usually see the following: a small banana grove immediately surrounding the house, behind which the double cropped plots could be found (maize+beans/sorghum), followed by the plots with only one harvest per year (for example a cycle of beans followed by fallow of eight months), and finally the plots that grew sweet potatoes or cassava, alternating with two to three years fallow. The pastures lay at the periphery of the farm, usually at the foot of the hill, thus separating the hill soil from that of the surrounding lower lying wetlands, cultivated once a year during the dry season.

It is often harder to identify clearly the cropping systems of today than those of the 1950's. Usually, one is confronted with combinations that are increasingly complex and it is very common to observe maize, beans, sorghum, sweet potatoes, cassava, etc. on the same plot. Not only has mixed cropping become nearly systematic, the succession of cycles of different species (and the repetition throughout the year of several cycles of the same species) has also complexified over time. From the 1960's through the 1980's, with increasing number of workers and mouths to feed, cultivated areas expanded at the expense of the few remaining pastures. Each different cropping system is was extended to the detriment of the neighboring system, usually less intensive. While the banana groves situated near the *ruogo* increased in size, the pastures situated at the farm's periphery gradually disappeared. When the last grazing lands were integrated into the cultivated area, the various "aureoles" that had once been quite visible became harder to see, appearing superimposed on top of one another in an area that itself had reduced in size (due to cultivation). Cassava and sweet potato are now dispersed throughout plots of grain and pulses while banana trees are planted in plots that already have grains, pulses and tubers. One can observe, then, the progressive appearance of two distinctive cropping systems on each landholding. On the one hand, an ensemble of plots (including the drained wetlands) with mixed

crops (grains, pulses, tubers) and on the other hand the dense banana grove and mixed shade crops.²⁹

The multiplication and expansion of banana groves is one of the clearest signs of evolution in the Burundian agrarian system since the 1950's. In the most densely populated regions, forests of banana trees cover hillsides. Except for a few of small regions in the country, the banana grove is the common denominator in the majority of peasant production units. Bananas have become the support of the peasant economy.³⁰ Today, banana beer and wine provide one of the principal sources of revenue for farmers as well as a significant caloric contribution to the daily diet. As a result, farmers have attempted to expand their banana plantations as much as possible, planting within them trees with deeper root systems such as fruit trees and *Grevillea robusta* (for timber and firewood). Currently, the banana grove constitutes the most efficient cropping system in terms of creating value per unit of land and per day of work. Indeed, planting bananas is the main way of increasing a farm's value and, along with coffee, the number one source of monetary revenue.

With regard to soil fertility, the banana grove plays an exceptional role in the Burundian agrarian system due to its high photosynthetic capacity, as well as the uniqueness of the product: the juice of the banana, used for consumption or fermented and sold as "beer." This form of consumption makes the "banana-beer grove" cropping system quite different from any other. The totality of the residues (banana skins, residues from the pressing operation) are restored to the grove's soil, as are the leaves and trunks of the trees chopped down after the harvest. There is practically no loss of mineral elements due to the harvest: the banana juice contains mainly water and sugar, and practically no nitrogen, phosphorous or potassium. Furthermore, the banana grove is a *bona fide* biomass factory (a "well" of carbon) capable of working year round and restoring nearly the entirety of its production to the soil. As a result, once in place, this crop system is self-sufficient, requiring no organic or mineral fertilizers: a windfall in Burundian agriculture. For this reason, the expansion of banana cultivation must be considered in relation to animal husbandry which, over time, it eventually replaces. The banana grove progressively supplants cattle herds as the main source of capital and way of renewing soil fertility³¹.

Multiplication of crop cycles (both on hillsides and in wetland areas), mixed cropping, the development of banana plantations, transformation of the soil fertility reproduction process, intensification of work and, finally, the doubling and trebling of food production (and its nutritional value): what has occurred is a true agricultural revolution without any industrial-based

production means, tools, fertilizers or phytosanitary products. It is, in some ways, the “doubly green” revolution that some experts have called for.³²

As opposed to the agrarian transformations of the 18th century which essentially resulted in an increase of labor productivity, the banana revolution was based on an increase in production per unit of land. The succession of bean+maize/sorghum also permitted such an increase, but without any real impact on the farming system since it implied an increase in livestock and therefore grazing areas in order to maintain the soil fertility of the cultivated area. The banana grove, however, has gradually replaced livestock, eventually dispensing with the animals and their pastures. Moreover, increasingly complex mixed cropping systems on hillsides and the multiplication of crop cycles in former marsh areas have led to more efficient management of resources and space. This is why the agrarian system can feed a population three times denser than the system previously in place, despite an increased portion of resources (land, labor, biomass) being redirected towards the cultivation of the cash crop coffee.

Towards a new agrarian system crisis?

Has the Burundian agrarian system again reached its limits? For how much longer will the increase in production be able to satisfy the multiplying mouths to feed? A few very densely populated counties (more than 500 inhab/km²) in the region of Buyenzi are actually well situated and it appears that there is still space and conditions for the intensification process to take place.³³ And, the Burundian agrarian system appears to be relatively resistant, demonstrated by its surprising ability to overcome difficulties since the start of the civil war. Despite nearly ten years of crisis, despite the total disorganization of the government and its paralysis, despite the loss of human lives and the forced dislocation of the population, food production has not dropped to dangerous levels.³⁴

Yet while there is still room for significant progress, soil fertility and biomass transfers once again are a problem. The accumulation of “soil fertility capital³⁵” has slowed down, impeded in innumerable ways. The use of biomass to benefit coffee cultivation due to imposed mulching,³⁶ shortage of production means, uncontrolled pest attacks especially on banana trees and beans, a relative pricing system that makes fertilizer and phytosanitary products inaccessible (due to the elimination of subsidies and public distribution centers) and repeated infringement of the right to access resources are among the many obstacles that have made it increasingly difficult to pursue

the intensification process that got began in the 1950's. The banana grove is no longer sufficient; its own sustainability occasionally at risk as the organic material is diverted to the benefit of other crops, notably coffee. This is why restoring fertility on the other plots, especially those where food crops are cultivated, must also involve the gradual implementation of biomass-producing trees with deep root systems as well as the introduction of external chemical fertilizers.

The obstacle impeding the continuation of these intensification processes is not found in the farmers' practices. Paths for the future have already been tested just about everywhere, most often within the framework of extension services, and the current crisis is in no way the result of exceeding the population ceiling imposed by the production capacity of the crop and livestock systems. Rather, the demographic capacity of the current agrarian system is limited by the conditions in which producers, now integrated into the market system, find themselves today, and the social relationships in which they are involved. Everything that was at one time the center of society in ancient Burundi is again at the heart of social relations: the concentration of soil fertility, its appropriation and its management. Indeed, concerned about the need to conserve and expand their principal source of currency (coffee) and, especially, the economic rent it represents as a main export good, government authorities have often defended their salaries and the nepotistic networks their social status gives rise to without considering the excessive opportunity cost that this represents for planters and the population as a whole.³⁷

The current crisis is of a totally different nature from the one triggered by the bovine pest (rinderpest) at the end of the 19th century. Its resolution will require a redefinition of the government's role in development and a serious examination of the relationships between the ruling classes and peasants. Such reforms would not result in creating the conditions necessary to the emergence of truly different agrarian system—what system could it be?—yet would facilitate the progress already underway. Indeed, the maximum capacity of the current agrarian system is far from being reached.

Conditions for agricultural growth

Innumerable works on the development of African agriculture, particularly in the highly populous Great Lakes region, point out in their introductions the theories developed by Thomas Robert Malthus and Ester Boserup. It is as if they are indispensable to the definition of the research

question or as if one or the other must inevitably be used as the basis of an interpretive model based on observed transformations. Let us see how.

Neo-Malthusianism to the environment's rescue?

At the end of the 18th century in England, Malthus³⁸ identified the level of food production (his “subsistence ceiling”) as an independent variable, that is to say only expandable by will and in proportion to the expansion of cultivated lands to the detriment of forests or the unlimited spaces of America. In these conditions, geometric population growth leads to the fatal meeting of two curves, the subsistence curve and the population curve, thus triggering a “regulation” cycle in which preventative checks operate on the wealthy classes fearful of dropping down a notch on the social scale (postponement of marriage and an increase in birth spacing) and positive checks such as famine, misery and infant mortality affect the masses. But misery was virtuous... By provoking a reduction in salaries, misery encouraged farmers to hire more people, particularly to increase clearing activities thus augmenting the cultivated area, which allowed the subsistence ceiling to rise, thus encouraging a rise in natality, until the conditions were again such to trigger a new regulation cycle. Pessimistic and fatalistic, smacking of an unshaken trust in the unchanging social order, Malthus neglects to recognize any form of technological change or social progress.

Nearly two centuries later in a very different demographic and historical context from that in which developing countries that have experienced their first demographic transitions, Neo-Malthusian approaches have underscored the degradation of living and production conditions as results of the population boom. Unless emigration is considered or the colonization of new lands becomes possible, increasing population density would necessarily lead to overexploitation of lands, decrease in soil fertility and accelerated degradation of the environment.³⁹

In Burundi, this school of thought deeply influenced the works of institutes of agricultural research (ISABU, in particular), the School of Agriculture at the University of Bujumbura and national and international research firms.⁴⁰ Its impact was also significant in terms of influencing public policies. By implying that the decrease of surface area per inhabitant is at the root of the reduction of pastures and fallow lands, a decrease of animal husbandry, reduction in soil fertility, aggravation of erosion, reduction in the size of farms, fragmentation of landholdings, deforestation and degradation of the environment--“demographic pressure” was made both the cause and the engine of the crisis. Whether these changes were really taking place or whether they were simply declared as such by urban intellectuals, the policies that subsequently followed were

simple. Impeded by the Catholic Church to undertake a vigorous birth control campaign, it became necessary to “fight” erosion, “protect” what remained of the forest and engage in reforestation. Agricultural techniques were invariably considered traditional and archaic, making it necessary to change them, which justified the overbearing technical assistance given to producers as well as the authoritarian deviations.⁴¹ By disqualifying peasant practices, there was no need to study them. This is why the Malthusian scenario had such a sterilizing effect on scientific research. Energy could now reassuringly be put towards research into “modern” technical packages that would be passed along to the extension services that would assure their dissemination.

Boserup, work-investment and the virtues of the market...

But the food crisis has yet to take place and with the evolution of food production matching up well with the demographic curve, many came to suspect and admit that a simple relationship can be established between demographic growth and production. This relationship, at times applied to the letter like when, in absence of reliable data from the field, statistics of production were revised upward by simply applying to them the growth rate of...population⁴². Was Boserup’s scenario the right one?

More than 150 years after Malthus and in reaction to the Neo-Malthusians schools of thought, Ester Boserup published in 1965 *The Conditions of Agricultural Growth, The Economics of Agrarian Change under Population Pressure*.⁴³ Now population growth became the independent variable. By provoking a decrease in the hourly productivity of labor and forcing people to change production techniques, population growth becomes a true engine of agricultural progress. Published during the population boom and based on a series of evolutionary systems supposedly characteristic in developing countries (the cycle of progressively decreasing length of fallow between periods of cultivation, going from the longest period of forest-fallow to multi-cropping (no fallow) passing through all the intermediary stages), Boserup’s text was optimistic and recognized value in peasant societies, attributing to them the endogenous capacity to evolve and modernize. Increased frequency of harvests, technical change and intensification, but under what conditions? Two were enough for the author: hourly productivity must be lowered since that will “motivate” farmers to change their techniques, and large amounts of supplementary labor must be mobilized collectively and dedicated to agriculture, particularly in the form of “work investment⁴⁴” in land developments that were evolving from one technique to another (swamp drainage, construction of terraces, hydraulic infrastructure, etc.).

Boserup's model arrived just in time. Its universal view⁴⁵ and the fact that the stages of the "exemplary" sequence could be observed in many regions of Sub-Saharan Africa gave rise to multiple applications of the model, including in Burundi. The multiplication of the number of crop cycles on the same land, whether hills or wetlands, increasingly labor-intensive crop systems—were they not the fruit of demographic pressure? Necessity dictates law, and demographic pressure eventually brought change.

Just like the Malthusian thesis, Boserup's model inspired decision-makers. Overpopulation of the countryside became an asset, the mobilization of manpower for work investment was the basis of "community development works," organized by the party UPRONA to fight erosion, clear and cut banana groves considered too pervasive by the government, build and maintain roads, etc. Since it was a question of valuing the *a priori* surplus and available manpower, little attention was given to the farmers' work calendar, despite being overloaded during certain periods. No one imagined that this work investment could take place within the peasant production units themselves, independent of any supervision. As such, the mobilization strategy very much resembled a renewed form of the forced labor tactics favored by authorities during the colonial period.

More recently, the neo-liberal discourse has appropriated Boserup's thesis⁴⁶. Since populations were capable of intensifying crop systems themselves, the government could massively withdraw from the productive sector and let the markets do the work. A third condition to progress was thus added to the two laid out by Boserup: producers' free access to a distortion-free market, capable of sending "signals" to farmers and therefore inciting them to achieve an "optimal allocation of production factors."

Demographic pressure and agrarian changes, the question at hand?

The history of Burundi offers an illustration of both Malthus' and Boserup's theses. There is no doubt that the crisis of the old agrarian system was a result of reaching the Malthusian subsistence ceiling, and the demographic curve was unable to overcome it until the late 1940's. In a second phase, however, the demographic curve seemed to be reaching the old limits and with it a new subsistence ceiling. Yet food production increased effectively at the same rate as the population explosion, and coffee production went up. Further, the effects of increased land

pressure on the cultivated plots were not negligible... But such illustration of one theory or the other can be found in many other regions in the world, which does not necessarily prove either.

In the end, whether inspired by Malthus or captivated by Boserup, everyone has come together over what appears to be the essential element: the population/resource relationship is the engine of agrarian dynamics. United in the utmost simplicity, the theoretical references rendered it unnecessary to look further and examine the true nature of the crises at hand, and identify the means that were needed to confront them.

By postulating that farmers needed to be constrained by necessity (such as demographic pressure), incited, motivated and mobilized in order to intensify their techniques and produce more, we came back to the age-old idea that the peasant farmer produced only the strict minimum for family consumption and creating a surplus was a foreign notion⁴⁷. Peasant practices were no longer “traditional” and “archaic.” Suddenly they had taken on an economic “rationality,” that of “self-subsistence logic,” a logic that closed in producers and impeded innovation proposed by agricultural scientists with the objective of increasing yields. It was thus this logic of self-subsistence that had to be changed. But at the end of it all, in light of the failed projects to this end, we ended up turning to the market and its virtuous incentives.

And what to think of these farmers who, apparently lacking foresight, continue to produce only the minimum necessary for the survival of their family? Does there exist a peasant that does not wish to increase his or her production? In reality, the desire to protect oneself against risk, unanimously recognized as being omnipresent in decision-making processes of producers, leads them to seek production that is superior to the bare minimum. In addition, accumulation has always been the engine of rural societies, regardless of their level of technology or development, and social differences the fruit of unequal accumulation of wealth. Whether this accumulation is in the form of “prestigious” goods (jewelry, fabric, rare and precious materials), stocked foodstuff or directly productive goods (livestock, tools, trees), no matter where it comes from or how it is preserved, the search for surplus is behind it all. No need for demographic pressure or signals from the market to incite one to produce more...

In Burundi, the accumulation of capital has always controlled, more than anything else, labor productivity. But because the highly productive nature of livestock has always been denied and qualified as “prestigious” husbandry, its role in accumulation and the overall dynamics of the

agrarian system was camouflaged. And what about banana cultivation, that capital invisible to the eyes of “developers.” Who would have attributed to this crop a role in the intensification of farming systems, growth in labor productivity and accumulation of biomass?

Accumulated fertility, social relationships and entry into market exchanges

As if closed in behind mountains that appeared to be lands of hope from the perspective of neighboring regions, the Burundians have stayed in their homeland, like the neighboring Rwandans, despite being condemned to less and less space due to population growth. The political frontiers, rarely crossed except to go to the British territories to escape colonial fiscal pressure (the only migratory parenthesis of any significance in the history of Burundi⁴⁸) surround the altitudinal ecosystems that were at the origin of high pre-colonial population density, thus contributing to confining the increasingly dense population to these areas. Yet their populations do not leave in search of land to cultivate. They leave to “look for money” only to come back to pay their taxes and invest their savings in livestock, coffee plantation or business assets. Contrary to most regions in the world, money transfers from abroad that could be used to maintain the rural economy by infusion are inexistent. Remittances from the city are also extremely scarce, owing to the low levels of industrial and urban development and the segmented nature of the labor market. This is particularly true in the public sector, to which access is mainly reserved for migrants coming from regions that are homelands for the country’s ruling families.

In light of this limited labor market and given the low opportunity cost of family labor, cultivating one’s own garden has often been the only option for the large majority of the population. Perhaps it is also due to the absence of alternatives and the inexistence of investment possibilities with immediate return that have contributed to the constitution of garden-orchards and agro-forest landscapes whose profitability is, in essence, deferred. As if closed in by the hills where they were born, the peasants that constitute the labor force are hardly tempted to undertake a rural exodus without any perspective of real emancipation. Rather, they dedicate themselves to working the land. No doubt this territorial confinement has been the source of a great deal of human misery and despair, particularly among young people who want more than ever access to other kinds of work. Yet it is indeed this absence of alternatives and this low opportunity cost that have been among the necessary conditions for the intensification of farming systems and the maintenance of a relatively stable level of food self-sufficiency.

Another necessary condition for the slow accumulation of “soil fertility capital” has been the relative security of land tenure. The Burundian royalty’s role in providing this stability during the pre-colonial period has long been suggested by Pierre Gourou.⁴⁹ With regard to the “banana revolution,” we emphasized the conditions that made this transformation possible: the population’s stability and territorial appropriation, the maintenance of a habitat fundamentally dispersed around which the banana trees were planted, the absence of a massive transfer of population and the absence of any authoritarian reorganization of the territory.⁵⁰

Ultimately, agricultural development in Burundi has always been turned inward and remains today centered on local markets despite the latter being limited to agricultural outputs and constricted in size. Protected by the 1,500 kilometers of bad roads that separate the country from the Indian Ocean as well as from trade barriers, Burundi has been able to master its integration into international markets and limit the destructive effects of its food sector. Despite particularly low labor productivity, agriculture is alive and well and the country has remained self-sufficient for a long time. The agrarian transformation of these last decades provides a surprising example of endogenous development, based solely on local resources. With regard to coffee, no need to open an old debate regarding the competition of food crops with cash crops. Coffee has been without a doubt the best vector of integration into international markets. Yet vigilance is necessary to ensure that the comparative advantage Burundi has most certainly enjoyed will not be reduced by the opportunity cost of transferring biomass to mulching, as it could have extremely serious indirect effects on the national economy.

¹ Republic of Burundi, Ministry of the Interior, Central Census Bureau, 1990: *Résultats provisoires, Recensement Général de la Population et de l'Habitation*, Gitega, November 1990 (last known demographic census).

² Illustrated, for example, by Verhaegen E., Degand J. and D'Haese L.: *Amélioration des systèmes d'exploitation agricole traditionnels au Burundi*, Projet Systra, Faculté des Sciences Agronomiques, Université du Burundi, Administration générale de la coopération au développement (Belgium), September 1991; see also *Mémorandum économique*, drafted by Nkurunziza F. (1993) for the World Bank.

³ The study of agrarian transformations, their conditions, modalities and consequences, is the aim of Comparative Agriculture. Influenced by the works of R. Dumont, Comparative Agriculture has developed considerably since the 1970's and the discipline now involves its own set of concepts (agrarian system), method (analysis-diagnostic) and theoretical developments (Shaner W. W., Philip P. F. and Schmel W. R., 1982: *Farming Systems Research and Development*, Westview Press, Boulder, Colorado; Mazoyer, M., 1987: *Dynamique des systèmes agraires*, Summary Report presented to the Committee on Agrarian Systems, Ministry of Research and Technology, Paris; Kroll J.C., 1992: *Les politiques publiques dans le développement de l'agriculture française et européenne*, HDR, Paris X-Nanterre; Dufumier, M., 1996: *Les projets de développement agricole*, Karthala, Paris; Mazoyer, M. and Roudart L., 1997: *Histoire des agricultures du monde, du néolithique à la crise contemporaine*, Seuil, Paris).

⁴ For example Péliissier P. and Sautter G.: "Pour un atlas des terroirs africains: structure-type d'une étude de terroir", *L'Homme*, Paris, 1964, IV, 1:56-72.

⁵ The concept was at that time defined as "an operating mode, historically elaborated and sustainable, adapted to bioclimatic conditions in a given space, and responsive to the conditions and social needs of the moment." (Mazoyer, M., 1987, op. cit., p. 6) and more recently as "the theoretical expression of a type of farming historically constituted and geographically situated, composed of a cultivated, characteristic ecosystem and a defined productive social system, thereby permitting the sustainable exploitation of the fertility of the ecosystem being cultivated" (Mazoyer, M. and Roudart, L., 1997, op. cit., p. 46).

⁶ This is the concept of "cropping system" defined by M. Sébillotte (Sebillotte, M., 1976: *Jachère, système de culture, système de production*, Institut National Agronomique Paris-Grignon, Paris, 1976).

⁷ Dolle, V., 1984: "Les outils et méthodes du diagnostic sur les systèmes d'élevage", *Les Cahiers de la Recherche Développement*, No. 3-4 (1984), Montpellier, pp. 89-96; Lhoste, P., 1984: "Le diagnostic sur le système d'élevage", *Les Cahiers de la Recherche Développement* No. 3-4 (1984), Montpellier, pp. 84-88; Landais, E., 1992: "Principes de modélisation des systèmes d'élevage", *Les Cahiers de la Recherche Développement* No. 32- 2 (1992), Montpellier, pp. 82-95.

⁸ In Comparative Agriculture, analysis takes place on three distinct levels: a region's agrarian system constitutes the first level of analysis, the farming system of a particular landholding the second or intermediate level and the study of the cultivated plot or animal herd the third or "micro" level of analysis.

⁹ Unit of residence, unit of consumption, unit of production and unit of capitalization are so often distinctive, although rarely independent of one another, that the search for an object to which the farming system concept could be applied is oftentimes unrewarding and unsatisfactory. See for example Gastellu, J.M., 1978: "...Mais

où sont donc ces unités économiques que nos amis cherchent tant en Afrique ?”, *Note de travail, Série: enquêtes et outils statistiques*, Vol. 1 – *Le choix d’une unité*, AMIRA, 1979, pp. 99-122.

¹⁰ Carried out within the context of a research project on Dynamics of Agrarian Systems in Burundi, coordinated by the author (UNDP/ISMEA/FSEA project).

¹¹ The majority of the material collected during the author’s fieldwork comes from the many interviews that were conducted with farmers, particularly old farmers. The objective is to try to identify, with the help of narrative histories, a set of concrete facts concerning agricultural and animal husbandry activities, and to reflect on the possible relationships that exist between each of these elements. However, to assemble these concrete elements, confirmed to be such by their repetition and overlapping across the interviews, it is necessary to base discussions on tangible material. Thus, the current landscape and its detailed analysis are used as the starting point for analysis and as a basis for interviews. To reconstitute the presence or absence of such and such characteristic in the landscape during each phase of history, it is necessary to always keep in mind the importance of precisely situating each element in time (during which period can this element be observed?) and in space, i.e., in the ecosystem (in which part of the ecosystem does it exist?). For more on a using a historical approach in Comparative Agriculture, see Cochet, H., 2001: *Crises et révolutions agricoles au Burundi*, INAPG – Karthala, Paris.

¹² This paragraph is based on an analysis of the main historiographic sources from this period. See, for example, Chrétien J.P., 1979: "Les années de l'éleusine, du sorgho et du haricot dans l'ancien Burundi. Ecologie et idéologie." in *African Economic History*, No. 7, pp. 75-92; Nsabimana T., 1988: *Food production history in Burundi: 1880-1945*, University of Wisconsin-Madison, USA.

¹³ For more on the introduction of these plants in this part of the world, see Chrétien J.P., 1979 (op. cit.); Chrétien J.P., 1998: "Anciens haricots et anciens tubercules dans la région des Grands Lacs", in Chastanet M. (ed.), 1998: *Plantes et paysages d'Afrique, une histoire à explorer*, Karthala – C.R.A., Paris, pp. 213-229.

¹⁴ This agricultural calendar was conserved in neighboring countries, such as Tanzania (Bahenduzi M., 1991: *Le rituel du Muganuro dans l'histoire du Burundi des origines au XXème siècle*, doctoral thesis, Université de Paris I Panthéon Sorbonne, C.R.A., Paris.).

¹⁵ This depiction is based on historical research that we have conducted in various regions of the country. This research has made it possible to roughly reconstruct the cultivation methods of the early 20th century. In high-altitude regions (around 2000 meters), rotations also included a cycle of garden peas, *Pisum sativum*, mixed with beans in a second season (see de Schlippé P. for the Bututsi region: "Enquête préliminaire du système agricole des Burundi de la région Bututsi", in *Bulletin Agricole du Congo Belge*, Vol. XLVIII, No. 4, August 1957, pp. 827-882). In Rutovu, in the Bututsi region, this double cropping of legumes (corn+beans/beans+peas) was repeated three times, after which the plot would be left fallow for two to three years (personal communication).

¹⁶ Cochet, H., 1998: "Burundi: quelques questions sur l'origine et la différenciation d'un système agraire", *African Economic History*, 26 (1998): 15-62, University of Wisconsin-Madison, USA.

¹⁷ This description of eleusine cultivation at the turn of the 20th century comes from interviews conducted in 1992 and 1993 with older Burundians. See also the description of de Schlippé P. (1957, op. cit.) for the Bututsi region.

¹⁸ Chretien, J.P., 1984: "Agronomie, consommation et travail dans l'agriculture du Burundi du XVIIIème au XXème siècle" in Cartier, M., editor: *Le travail et ses représentations*, Paris, pp. 123-178; Mworoha, E., 1977: *Peuples*

et rois de l'Afrique des Lacs, le Burundi et ses royaumes voisins, Nouvelles éditions africaines, Dakar/Abidjan; Botte, R., 1969: "Burundi: la relation ubugabire dans la tête de ceux qui la décrivent" in "Les relations personnelles de subordination dans les sociétés interlacustres de l'Afrique centrale" *Cahiers d'Etudes Africaines*, Vol. IX.3 No. 35, pp. 363-371.

¹⁹ Cochet H., 1998 (op. cit.).

²⁰ Thibon, C., 1987: "Un siècle de croissance démographique au Burundi (1850-1985)" in *Cahiers d'Etudes africaines*, 105-106, XXVII – I – 2, 1987, pp. 61-81.

²¹ Thibon, C., 1989: "L'expansion du peuplement dans la région des Grands Lacs au XIX^e siècle," *Canadian Journal of African Studies*, Vol. 23 / No. 1, Association canadienne des études africaines, pp. 54-72.

²² Thibon C. (op. cit.), Botte R., 1985: "Rwanda and Burundi, 1889-1930: chronology of a slow assassination," Part 1, *International Journal of African Historical Studies*, 18, 1 (1985), pp. 53-91. The older works [Meyer, H., 1916: *Les Barundi, une étude ethnologique en Afrique orientale*, critiqued and annotated by J. P. Chrétien, Société Française d'Histoire d'Outre-Mer, Paris, 1984; Greef de G., 1919: "Monographie agricole de la région de l'Urundi", in *Bulletin Agricole du Congo Belge*, Vol. X, No. 1-4, pp. 2-71] attribute the 55-65% decrease in herds to the rinderpest (50 à 90% according to Nsabimana, T., 1988: *Food production history in Burundi: 1880-1945*, University of Wisconsin-Madison, USA). Added to this are the subsequent losses (starting in 1905) caused by sleeping sickness, estimated to be extremely high in warm regions.

²³ Hartwig, G.W., 1978: "Social consequences of epidemic diseases: the nineteenth century in Eastern Africa," in G. W. Hartwig et K. D. Patterson, (eds.), *Diseases in African History, an Introductory Survey and Case Studies*, Durham, NC, pp. 25-45.

²⁴ The role of ecological imbalance in the development of sleeping sickness in all of East Africa is shown by Ford (Ford, J., 1971: *The Role of the Trypanosomiasis in African Ecology. A Study of the Tsetse Fly Problem*, Oxford) et Kjekshus (Kjekshus, H., 1977: *Ecology Control and Economic Developments in East African History: the Case of Tanganyika, 1850-1950*, London).

²⁵ A hectare of corn+beans/sorghum that is continually planted and fertilized with dung, a hectare of eleusine alternatively left fallow for several years, an area of grazing lands large enough to be able to feed all year long the livestock necessary for maintaining the fertility of the doubled cropped corn+beans/sorghom plots (Cochet H., 1998, op. cit.).

²⁶ We have debated elsewhere the use of (quite unreliable) statistics, to supposedly demonstrate a tendency towards the decrease of food production per inhabitant, a decrease not proven elsewhere (Cochet, H., 2001, op. cit.).

²⁷ The arable surface area appears to have increased from 23% to 54 %, according to different estimates, between 1950 and 1990 (Ndimira, P-F., 1989: *Evolution de l'agriculture au Burundi depuis l'ère coloniale jusqu'à nos jours (période 1916-1987)*, draft version, Faculté des Sciences Agronomiques, Département de socio-économie rurale, Université de Bujumbura, Bujumbura).

²⁸ Cochet H., 2001 (op. cit.).

²⁹ This evolutionary process is extremely complex. Innumerable variations can be identified not only in each region of the country, but also for each hill and mountain slope. For a more detailed description of the process, see Cochet H., 1997: "Agriculture paysanne et production alimentaire au Burundi" in Haubert M., (editor) *Les*

Paysans, l'Etat et le Marché, Sociétés paysannes et Développement, Publications de la Sorbonne, Paris, pp. 225-240.

³⁰ F. Bart has also emphasized the importance of this crop in the Rwandian hills (Bart F., 1993: *Montagnes d'Afrique Terres Paysannes, Le cas du Rwanda*, Espaces Tropicaux n° 7, Centre d'études de géographie tropicale/Presse Universitaires de Bordeaux, Bordeaux).

³¹ For a thorough analysis of this conclusion, see Cochet H., 1993: "Productivité du travail et accumulation du capital dans les exploitations agricoles paysannes du Burundi", *Mondes en développement*, Vol. 21, 1993, No. 82, ISMEA-Paris and CECOEDUC-Brussels, pp. 65-84.

³² M. Griffon (editor), 1996: *Vers une révolution doublement verte*, Fondation Prospective & Innovation, CIRAD.

³³ Neville A., 1992: *Diagnostic du système agraire du Buyenzi (Burundi)*, Mémoire de DAA, INAPG, Chaire d'Agriculture Comparée, Paris.

³⁴ Bourgerie J., Lecompte, D., and Martin, S.,: *Economie burundaise: adaptation à la crise politique*, note CFD, Bujumbura, August 1995 (roneotyped).

³⁵ The biomass accumulated on a farm (above-ground wood biomass, but also organic matter stocked in the ground) has become, nowadays, the principle source of wealth for the landholding and determines, for the most part, the level of labor productivity achieved. The concept of "soil fertility capital" refers to this wealth.

³⁶ Mulching consists of spreading a thick layer of organic material over the plots where coffee is cultivated. Farmers must find the mulching material wherever they can, usually on the other plots of his production unit (agricultural residues, leaves and trunks from banana tress, cut grasses, etc.) This technique helps renew fertility, hinders weeds and helps keep the soil from drying out during the dry season. For more on the consequences of this practice on the Burundian agrarian system, see: Cochet, H. and Ndarishikanye, B., 1998: "Les fondements de la crise caféière au Burundi", *Mondes en développement* - 1998 - Tome26104, pp. 53-71.

³⁷ Cochet, H. and Ndarishikanye, B., 2000: "La production caféière au Burundi: Agronomie, vulgarisation et rapports sociaux", *Canadian Journal of African Studies / Revue Canadienne des Etudes Africaines*, Vol. 34, No. 2, 2000, pp. 218-248.

³⁸ We are referring to *An Essay on the Principle of Population*, published in 1798. This essay inspired the better-known 1803 text.

³⁹ For more on this debate that took place in the 1950's between the Malthusians and the "optimists" see Sauvy, A., 1958: *De Malthus à Mao Tsé-Toung, Le problème de la population dans le monde*, Editions Denoël, Paris.

⁴⁰ The incisive Malthusian concept regarding food supply and demand has provided the basis of a number of works on this topic by research institutes, universities and consulting firms. It has reappeared in publications of the Ministries of Agriculture and Planning, as well as international donors. See, for example, the *Mémoire Economique* of the Country Representative of the World Bank in Burundi, drafted in 1993.

⁴¹ Guichaoua, A., 1989: *Destins paysans et politiques agraires en Afrique Centrale, tome 1: L'ordre paysan des hautes terres centrales du Burundi et du Rwanda*, L'Harmattan, Paris.

⁴² For more on Burundian statistics and their use, see: Poupard P., 1989: "La mise en place de bases de données agricoles. Quelques réflexions à partir de l'expérience du Burundi", *STATECO No. 57*, INSEE, Paris, pp. 67-84; Bidou J. E., 1989: "Production vivrière et autosuffisance alimentaire au Burundi, une critique des sources

statistiques", in Département d'Histoire de l'Université du Burundi: *Histoire sociale de l'Afrique de l'Est (XIX^e-XX^e siècle)*, Karthala, 1991, Paris, pp. 251-267; Cochet H., 2001 (op. cit.).

⁴³ George Allen & Unwin LTD, London, 1965.

⁴⁴ Boserup uses the terms "investment" or "rural investment", although she is often referring to investment in the form of work rather than capital.

⁴⁵ Albeit limited to pre-industrial societies, as is underlined in the preface to the French edition.

⁴⁶ This approach is illustrated by M. Tiffen, M. Mortimore et F. Gichuki in a recent study of the Machakos district in Kenya, financed by the World Bank (Tiffen, M., Mortimore, M. et Gichuki, F., 1994: *More people, less erosion, environmental recovery in Kenya*, Overseas Development Institute, London, UK, John Wiley and Sons Editor, Chichester). It is without a doubt in this case that the relative proximity of the markets of Nairobi have played a decisive role in the intensification of farming systems in this region.

⁴⁷ One of the precursors of this change in approach was P. Leurquin (Leurquin P., 1957: "Les limites physiques de la production de subsistance", *Bulletin de l'Institut de Recherches Economiques et Sociales de l'Université de Louvain*, 1957, 23, pp. 59-66.)

⁴⁸ To which we must now add migration due to the current political-ethnic problems.

⁴⁹ Gourou, P., 1953: *La densité de la population au Ruanda-Urundi. Esquisse d'une étude géographique*, Institut Royal Colonial Belge, Section des sciences naturelles et médicales, mémoires No. 8 Vol. XXI, fasc. 6, Bruxelles.

⁵⁰ Cochet, H., 2001 (op. cit.).