Rigidity Versus Adaptation: Contribution to the Debate on Agricultural Viability and Forest Sustainability in Southern Cameroon

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Introduction

The forest of the Congo Basin—known as equatorial forest—covers a surface area of almost a million square kilometers. It is the second forest ecosystem in the world after Amazonia and represents nearly 16 percent of the global biodiversity. The equatorial forest in Africa is made up of many strata and has a great variety of tree species, approximately a thousand of them. Southern Cameroon, with its dense humid evergreen forest—27 percent of the country’s land area (Gartlan 1992:119-124)—is part of this natural amphitheater. Gockowski et al. (1998:3-4) reveal the existence of a decreasing gradient of demographic pressures and for the use of natural resources following a north-south trajectory; that is, from Yaoundé, in the center of the country, to the border with the Republic of Gabon. The agricultural system in the region is centered on food crops, cash crops (essentially cocoa, palm oil, and coffee), and home gardens. Globally, this system remains homogeneous in its process and functions.

The last two decades were characterized in the tropical regions by the increase of agricultural surface areas due to slash-and-burn agriculture, forest agriculture, or shifting cultivation. Recent statistics from the FAO (1997:3-10, 2001:2-8) indicate that this agricultural system is an important cause of deforestation. In Cameroon, slash-and-burn agriculture is considered responsible for almost 85 percent of annually deforested surface areas (MINEF 1994:5-6; ASB 2001:3-4). Oyono (1998) notes that with the current economic crisis, there has been, in ten years, a notable increase in cultivated areas among small farmers, from 0.30 ha to 1.10 ha. In such a situation, and with regard to the underlying economic and ecological stakes, searching for a long-term peaceful co-existence between agricultural practices and sustainable management of forests is imperative. It is a question of strategic interest for research, for agricultural policies, and for forest management policies. According to Colfer (1993:3-8), among other common beliefs and misconceptions, it is often said that “shifting cultivators are primitives and resistant to change.” In fact, there is an opposition between those who propose that this agricultural system (and natural resource management system, to a certain extend) should be stopped and be replaced by alternatives likely to reduce its expansion, and those who minimize and/or do not bother with the necessity of such alternatives.

If North American and European experiences aiming at stabilizing agriculture have had very significant impact on the conservation and the reconstitution of the forest cover (Mather 2001:35-52), there is no theoretical and operational consensus on this subject in the tropical regions (Angelsen and Kaimowitz 2001:1-18). Most of the theoretical and/or practical solutions are partial and precarious. In the particular case of southern Cameroon, such limits stem from the deep conflict between the indigenous system—that is, shifting cultivation—and the technical or expert system, based on the introduction of alternative technologies. In the light of reflections, interviews, and observations conducted in the field by the Center for International Forestry Research (CIFOR) in Cameroon,1 this article is a contribution to documenting that conflict.

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1

In the first section, a brief review of the slash-and-burn system is presented that highlights key reasons for its persistence/resilience and exposes its limits, as well as the criticisms made against this form of production. The second section assesses the deepness of the opposition between this system and alternatives suggested or
implemented by scientific and expert approaches. These alternatives are part of a global body of efforts aiming at bringing the Bantu peoples of the Congo Basin to join the “world” of Homo sustensis, the human that live in accordance with sustainability, as pointed out by Siebenhüner (Ruitenbeek and Cartier 2001:25-26). Before drawing some conclusions, the article recommends an adaptive model of co-existence between this systems and the scientific alternatives, and develops general lessons likely to captivate the interest of researchers and policy-makers.

The study covered the whole humid forest zone of Cameroon, with a total of 15 sampled villages. Its objective was to characterize the shifting cultivation system, with a focus on socio-cultural explanations for the continuation of slash-and-burn to understand the dilemma it represents, and to critically consider proposed expert and conventional alternatives. Our methodological approach included for data collection includes an in-depth literature review; “comprehensive” surveys during village meetings; discussions with key informants; interviews of researchers; historical transects of landscapes; and agro-ecological mapping. After a first round of data analysis, preliminary information was shared at the village level, before being organized for the production of this paper. (See Figure 1.)

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**Figure 1**

*The Rainforest Zone in Cameroon*

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### The Dimensions of Slash-and-Burn Agriculture

#### An Attempt at Characterizing

Though perceived nowadays as a casse-tête chinois (Chinese puzzle) by scientists and policy designers, slash-and-burn agricultural system has been practiced for thousand of years, as noted by Gillon (1992:19-29) and by Zhang (1995:50-51). The literature suggests basic characteristics that make it possible to define it, though this form of production remains complex (Mayong et al. 1996:1-2). For example Fujisaka and Escobar (1997:4-6) set up a scale of characterization criteria, the most significant of which are the “initial vegetal cover,” “the resource users,” “the final vegetal cover,” and “the falls periods.” The basis of this agricultural system lies in the technique known as “slash-and-burn,” marked by the clearing of a forest space and its occupation (Santoir 1992:48-53; Devineau and Guillaumat 1992:79-89). As a result, there is a shifting of cultivation periods, two to three years, and a fallow period in which the soil is supposed to reconstitute its fertility. Santoir (1992:52) evaluates the minimum period for falls at three years for the cultivation of groundnuts and 15 years for plantain (Musa spp) or for ngon, a local variety of cucumber (Cucumeropsis mannii). Westphal (1981) has distinguished two types of falls: forest falls and “gramineae” falls. Forest falls, or old falls, are represented by secondary and regenerating units, generally more than ten years after a first cultivation operation. “Graminean” falls are made up of younger falls, marked on the whole by the absence of tree species.

In a simple way, a peasant in southern Cameroon described the process as follows:

After the first clearance of a portion of dense forest, various crops are cultivated, like *Arachis hypogea* (groundnut), *Zea mays* (maize), *Manihot utilisima* (cassava), local varieties of vegetable, plantain, and cucumber. The following years, the place becomes a fallow. Then plantain and cucumber can no more be installed there. To cultivate these two crops, it is necessary to move ahead in the dense forest. Our agriculture implies the transformation of a forest formation. But we don’t go too far. It is corresponding to our subsistence style since centuries.

Slash-and-burn agriculture is based on the cycle of rains and the availability of water. First, because peasants adjust field preparation, after slash and burn operations, to the availability of water; second, this water facilitates the absorption of mineral elements by the soil.
after the planting operation. Such an “internalization” of water by leads to a better growth and development of crops.

**Historical and Socio-cultural Roots**

Waves of migration along the 18th, 19th, and 20th centuries undertook to occupy and to transform the forest environment in the Congo Basin to a more humanized space. In the case of southern Cameroon, for peasants the forest space has gradually taken the configuration of a stock of “lands” and territories. As such, each ethnic group has shaped an identity of its own. Western explorers have, in an exotic mode, identified those humanized blocks of vegetation under the form of small islands in the “sea” of dense forest. Despite the lack of relevant ethnobiological research on the socio-cultural foundations of slash-and-burn agriculture in the Cameroonian context, we can nevertheless try to show that, as a support for the clearing of forest, slash-and-burn agriculture draws its historical consistency from three socio-cultural factors.

First, it has helped each of the human groups who practice it to create a “country,” in other words a “land” with “internal frontiers.” Within the context of migrations followed by inter-ethnic conflicts, it appears as an instrument for the demarcation of the space and for the security of access to land. After every cultivation cycle, some markers—indigenous palm oil trees, some fruit trees, a “fetish tree”—sealed this process of appropriation. For that, slash-and-burn agriculture gives more coherence to the tropical saying, “land belongs to the first occupants” (Santoir 1992:80-92). This principle was solidly codified in the rules and regulations governing land use, as documented by Weber (1974:22-35), Short (1994:45-49), and Diaw (1997:4-10). Thus, as a general rule, when a lineage group willingly abandoned a space already occupied, according to Oyono et al. (2000:9-22), it always developed an affective and mental relationship with the resulting bilik (former “land” or abandoned villages).

Secondly, shifting cultivators argue strongly that this system plays a role of lever in the social fragmentation that substantially structures ethnic and/or lineage reproduction mechanisms in Southern Cameroon. Traditionally, these diffused societies have no hierarchical political power, each lineage being a politically autonomous unit. They accordingly have no centralized authority acting as a master of land (Short 1994:45-49; Mbembe 1996:12-15). Due to the fact that virgin land in a given ethnic or lineage “country” is a common property resource (Diaw and Oyono 1998:37-40), the principle of lineage segmentation in these societies requires that when already an adult, a young man should clear a portion of forest far from the family land so as to settle there with his wife. Through shifting cultivation, each new social entity becomes an autonomous hamlet. That is the contribution of this agricultural system in the diffuse character of societies in southern Cameroon.

Thirdly, slash-and-burn agriculture builds an ecological culture and bequeaths a well-defined morphology to the natural environment. The new space that is born of it is characterized by a specific identity forged by some elements. We therefore refer to the species known as indicators of fertility, like assas (Macaranga hurifola), ayous (Triplochiton scleroxylon), fraké (Terminalia superba), adum (Cylocodiscus gabonensis), ebaye (Pentaclethra macrophila), etc. We also refer to the construction of a mental and ecological cartography of the whole forest space. Similarly, a geography of the economy of subsistence is drawn up through this agricultural system, with lands under cultivation, areas of semi-domesticated resources, extra follows, areas of spontaneous resources, and small hunting corridors. To sum up, this is a system of environment management that is the foundation of an adaptive agreement between several ingredients including ecological factors, the technological capacities of human groups, social reproduction, diversified subsistence strategies and spatial imaginary, hence its resilience.

**Slash-and-Burn: An Ecological Dilemma**

Zhang (1995) eloquently shows that slash-and-burn agriculture is a simple extensive model. Supple cultivation techniques, light management operations of the space, and elementary tools are used in this system. In the case of southern Cameroon, this system rests on a maximum use of water during the rainy season, to withstand the cultivation cycles. The largest quantities of soil and nutrients are made available through the burning operation, to support the growth and development of crops for a period of at least two to three years. Similarly, the acidity of the soil is reduced by ash, which causes an increase of the pH, with remarkable advantages for the growth of crops.

In addition, it is recognized that slash-and-burn operations kill wild grass and their seeds, as well as eggs of pests, which makes it possible to have control over diseases affecting crops. Such advantages, accumulated over time and space, are a strong justification of the historical continuity of forest agriculture as a system of production. As a general rule, forest agriculture is a self-sufficient system less dependent on external influences and inputs, such as agricultural and agro-forestry technologies. If
farmers proclaim its sustainability, at least from their own point of view, and declare that it contributes to optimizing the management of natural resources, dependency on forest in order to increase food production represents an ecological stake and, thus, is of scientific interest.

Arguments developed by critics of slash-and-burn agriculture are based on a variety of factors. The most outstanding is the mobility of the system in time and in space, thus inducing a reduction of the surface area of forest and, in a related vein, of biodiversity. Such an extravagant and extensive system is in contradiction with its very low efficiency and supposed ecological sustainability. The results of agricultural surveys conducted in southern Cameroon have led to the observation that the surface areas of this system have experienced a sustained and continuous growth. Thus, MINEF (1995:3-7) underlines that this agricultural system was occupying 3.2 percent of the national territory in 1972/73, 3.8 percent in 1984, and 4.5 percent in 1990/91.

Historical transects carried out by peasants in the whole zone from 2000 to 2001 under the methodological guidance of CIFOR, and spread out on twenty-five years, show that the “forest is on the decline” in all villages, because of food agriculture (Tian 2001:5-6). Mala et al. (2001:3-8) conclude, after this exercise, that in some villages this agricultural system occupies 70 to 80 percent of the forest space. Manyong et al. (1996:6-21) note that the driving forces for agricultural intensification in Central Africa as a whole include access to wholesale markets, major profitable cash crops, and land-use intensity.

Cocoa farming, which was introduced in the Cameroon coastal region by the Germans around 1886, has spread inside the country very rapidly (Santoir 1992:61-65). As such, it has increased the process of final settlement of populations in villages. It also played a central role in the emergence of financial accumulation strategies in indigenous economies. Oyono (1998:557-559) emphasizes that with cocoa, “The domestic financial accumulation was so substantial that money income generated almost entirely supported schooling of children, access to modern health care, improvement of rural settlements....” During almost the entire 20th century, the model of rural financial accumulation was centered on the marketing of cocoa. With the drastic drop of the market price of this cash crop in the mid 1980s, farmers refocused strategies for yielding financial incomes on food crops.

Besides, in the early 1990s, international cooperation made important funds available to the Cameroonian farmers, subject for the latter to be organized (see Oyono and Temple 2003:69-73). By the way, many farmers’ organizations have been created with the goal of capturing portions of available funds and, accordingly, implementing small agricultural common initiatives. Such developments led to an unprecedented intensification of food agriculture, or subsistence agriculture, and consequently to the spatial decline of forests. With determinants like the amplifying demographic pressure, migrant repatriation to their villages resulting from the exhaustion of the urban model of well-being, and the induced effects of a persistent economic crisis in rural areas, an expansion of shifting cultivation seems irreversible in provinces like the South and the East where forest lands are still abundant.

As a result of this influence and its dynamic trends, there are a series of severe problems of impact. At the ecological level, it must be noted first of all that the cultivation of a forest space causes substantial qualitative losses due to the destruction of species when clearing is done. Taking into account the considerable number of species contained in the local forest ecosystem (about eight hundred tree species), as well as stocks of micro-flora and micro-fauna, slash-and-burn agriculture may look like a disaster from a given point of view. To that it must be added that the erosion of soils and the reduction of fertility arising from the destruction of the forest cover. According to Marticou (Santoir 1992:51), the total restoration of the quality of forest soils after three years of cultivation requires at least twenty-five years. Finally, it must be considered that non-cultivated spaces next to cultivated spaces suffer in one way or another from the influences of that agricultural system.

Spatial competition between slash-and-burn and forest is noted at agricultural borders through a well-known scenario. The natural environment is reduced by the clearing operation. The density of forest is thus simplified for the installation of various crops. As a result, there is a “tri-stratification” or a “bi-stratification” of the landscape in constituted agro-ecological units: afu ovondo (groundnut farm); esep ngon (cucumber farm); esep bikon (plantain farm). There is scarcely a “mono-stratification” of the landscape, except for truck-farm produce and maize farms. As one can see in the Figure 2, slash-and-burn agriculture leads to the metamorphosis of the forest, with crop farms “today,” young fallows “three years later,” old fallows “seven years latter,” secondary forests “ten to fifteen years latter,” and dense forest “thirty years later” (Diaw 1997). In order to maintain and/or increase the production level, this system needs to be mobile across space. Science, therefore, considers that such an expansion contributes to reducing forest surface areas and correlative bio-ecological stocks.
Response to the Rationalization of the Frontier Between Agriculture and Forest

A first body of theoretical responses concerns the “developmental” approach characterized by Boserup’s model (1981), for which demographic growth, far from being a constraint, is rather an asset in the sense that it gives way to new forms of technological creativity among farmers. Another body of theory advocates the introduction of agricultural technological innovations and the implementation of changes in the social fabric and in institutions (Sonja 2001:99-120). Such changes are considered decisive and as operational approaches essential for ensuring transition from indigenous agriculture to sustainable and productive agriculture (Binswanger and Ruttan 1978:99-120; Binswanger and Pingali 1987:19-20).

Simultaneously, Borlaug (1992:20-30) and Manyong et al. (1996:4-7) placed strong emphasis on diversification and direct accumulation. The increase in agricultural income, or the diversification of the sources of income, are supposed to dissuade farmers from continuing to open up forests. Other alternatives should be identified. In order to reverse the trends of imbalance between the expansion of slash-and-burn agriculture and forest space, three important variables constitute the knot of research initiatives on agricultural sustainability in the Congo Basin. They are demographic pressure, agricultural technologies, and institutional changes. If these variables are optimized, the following profitable effects for sustainability and human well-being could be obtained: stabilizing agro-ecological units, optimizing the sequestration of carbon, stabilizing and/or increasing incomes, and improving and sustaining food security.

Technician and Expert Responses Based on Bio-ecological Considerations

The implication of research in solving the dilemma represented by slash-and-burn agriculture is demonstrated by operational responses under the form of experimental models. In so doing, several conventional research organizations and non-traditional actors (NGOs among others) collaborated in research projects. A number of models are emerging within such collaborative efforts.

i) Permanent Agricultural Systems

The International Institute of Tropical Agriculture (IITA, Humid Forest Ecological Center, Cameroon) and the national Institut de Recherche Agricole pour le Développement (IRAD) are presently working on the implementation of models of *Theobroma cacao* (cocoa) agro-forests and models based on *Elaeis guineensis* (palm oil tree). In addition, a new action research initiative, hosted by IITA, and known as “Sustainable Tree Crops Program” (STCP), is presented as an effort aimed at increasing productivity, income, and protection for the environment (STCP 2003:2). As such, this program could, among others, contribute to the implementation of sustainable landscape units based on cocoa in the humid forest zone. All these experimental models are legitimized by the fact that biological diversity is focused on well-determined species.
More over there is a more permanent, intensive, and stable floristic stratification. These models are economically relevant because cocoa and palm oil generate more financial revenue than food crops. Experimenting with and developing such models is presently a matter of special scientific attention. In the same category of alternatives conceived by experts, there is the taungya system introduced in Asia for decades and briefly experimented with in Cameroon by the Office National de Développement des Forêts (ONAFDEF). The objective of this agrosilvicultural model is to combine, in state forest reserves, forest regeneration/development and food crops; that is, the use of the same forest space by both ONAFDEF and local communities.

**ii) Semi-permanent Agricultural Systems**

This is a group of improved fallows systems (Gockowski et al. 1998). They are obtained through the introduction of shrubby leguminous plants such as Calliandra spp., herbaceous leguminous plants (e.g., Mucuna spp and Puereria spp.), and consumed leguminous plants such as Phaseolus spp in afub owondo (groundnuts farms). However, there is an evolution in this approach for improving fallows. Initially, research institutes such as the International Center for Research in Agro-Forestry (ICRAF) and, more particularly, IITA tried to introduce shrubby leguminous plants amongst farmers. Finally, the adoption process registered mitigated results, as small farmers were instead expressing their interest in consumed leguminous plants. There are other permanent sub-systems that are often referred to by conventional research as a technological alternative for the stabilization of slash-and-burn agriculture, such as intensive and improved home gardens or improved “village agriculture.”

**The Model of Agricultural “Containment” Through the National Forestry Zoning Plan**

Reforms of the Cameroon’s forestry policy are based, among other instruments, on a “Zoning Plan,” which proposes a carving of the forest domain into functional and specialized spaces. The 1994 forestry law had enshrined the creation of community forests at the level of villages and of council forests at the level of rural councils. In Cameroon, councils are local governments, with a territorial basis made up of a given number of villages. As a result of these changes of policy, the forest space has gone through a cycle of specialization (Karsenty 1999:4-7), with: (i) a private state land (protected areas and forest reserves); (ii) forest concessions (for logging); (iii) council forests; and (iv) community forests/agro-forests.

These various authoritarian “set-ups” have led to a de facto settling process of slash-and-burn agriculture in agro-forest portions (see also Dounias 1995:381-392), while the other forest spaces are submitted to other forest uses. As for the models described above, this one also implies the stabilization of the indigenous agricultural system.

It exerts considerable attraction on international NGOs working for the conservation of protected areas in southern Cameroon. Ecologists, conventional experts, and many practitioners hope that it can stop encroachment on dense forest, with all the negative effects described above.

**Preliminary Considerations**

Despite existing responses to the dilemma of slash-and-burn agriculture, it must be reckoned that the introduction of exotic species favored by some jeopardizes the social and bio-ecological feasibility of innovations. These species are in contradiction with the local strategies of natural space management and of the manipulation of plants. In the context of southern Cameroon, the option of agricultural stabilization is accessory only in areas where the demographic pressure is very high and the forest potential already exhausted. This is the case of areas situated to the north of Yaoundé, the capital city of Cameroon. This option may also go along with the process of implementation of community forests, protected areas, and in areas where agricultural lands can no longer be extended.

The second consideration refers to the fact that the indigenous system is fundamentally diversified and rests on a combination of mobility (in the case of food crops) and stability (in the case of cash crops) in the shaping of local agro-ecological identities (see also Manyong et al. 1996: 35-36). This global and dynamic system rests on a given spatial structure (Strayer et al. 2003:723-724), including the afub owondo, the esep (forest farm), home gardens, fallows (young and old), cocoa farms and palm oil plantations. According to farmers, there is a process that goes from the degradation of natural ecological units (e.g., dense forests or secondary forests) to the vegetal reconstitution through productive cycles and simplified units, as well as permanent agro-forests. An optimized management of natural resources within a stock of agro-ecological units is expected from such a vegetal segmentation. The survival or the historical persistence of slash-and-burn agriculture is therefore largely based on this combination, which sometimes overlaps.

Another lesson can be drawn from the dynamics analyzed in this article. There is an expansion of agricultural specialization in the southern Cameroon region. Such a specialization is achieved through the intensification of...
village palm-tree farms, at the instigation of the urban elite, as well as the cultivation of cucumber. Palm oil cultivation, which is a determining factor for land security and is socially considered as prestigious, generates substantial financial incomes to specialized farmers. An agricultural expansion is also noted in many areas as regards to the cultivation of cucumber. This is the most financially profitable food crop, hence its attraction. Cucumber is planted at the beginning of the agricultural cycle. Thereby, the dense forest is cleared to give way later to a succession of other sub-systems of cultivation.

The fourth consideration deals with a permanent tension between scientific/experts’ conventionally theorized systems and the indigenous system, generally rejected and characterized as backward by those experts (Ribot 2001:3-4; Müller 2003:20-21). In their original intentions, the supporters of conventional systems seek to disqualify the native systems, so as to enclose, reduce and eliminate them (see Diaw 1998:3-10; Ribot 2001:4-6). As a general rule, such strategies are not preceded by analyses based on cultural diversity or other human factors. Concerning slash-and-burn agriculture, the limits conferred on it by science are more, if not exclusively, bio-ecological. Its socio-cultural dimension is generally of no importance. Whereas its current and, may be, future resilience strongly rests on the latter.

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Notes

1. This paper is drawn from one of the research components of the whole CIFOR-Cameroon program titled “Developing collaborative monitoring for adaptive co-management of tropical forests.”

2. There is, everywhere, an emotional link between local communities and their blik.

3. This process is described as follows by a peasant: “When I was born seventy-two years ago, this village was not at the place it is now. Our parents where living down there, near by the river you saw before coming into the village. The social group was very small at that time. When I was like ten years, many young men started crossing the river when they were about to get married. The forest was cleared for a subsistence plot, enabling to that effect the young couple to found an economic autonomy; a house was built besides; each plot was afterwards converted into a territory. Forty years after, these territories became hamlets and gave to the village the scattered configuration it has today.” Source: Pierre Mfoulou, Village Ma’anemezam, near by the town of Ebolowa (South province), November 10th, 2001. Translated from the Bulu language by the authors.

4. Studies carried out by the ministry of Agriculture in 1972/73 and then from 1984/85 to 1990/91 make it possible to have an idea of the extension of agricultural surface areas in Cameroon (MINEF 1995:12-13). The low percentage of the surface area occupied by this activity on the national territory may however raise questions. As a matter of fact, one may wonder why so many grievances are made against that type of agriculture whereas it occupies less than 5 percent of the national territory (3.2 percent in 1972/73, 3.8 percent in 1984, and 4.5 percent in 1990/91). However, it is necessary to mince any optimism. By paying attention to agricultural surface areas only in forest provinces in the strict sense of the word, the following variations can be obtained: Center province: 3.3 percent in 1972/73 and 5.6 percent in 1984; South province: 1.2 percent in 1772/73 and 2.4 percent in 1984. If reliable data could be regularly collected, these figures would certainly multiply in the long run.

5. The questioning of the dynamics of slash-and-burn agriculture in southern Cameroon and in the whole region of Central Africa. Has made it possible to identify the break between attempts of rationalizing this system and the driving forces of its expansion, at bio-ecological, social and cultural levels. These elements generate and develop productive agricultural mosaics. They must be taken into consideration in defining and promoting agricultural dynamics and in defining natural resource management options. Such a complexity calls for an adaptive junction of modern agricultural technologies and native systems. We have been informed by farmers that there exits local indicators for agricultural and forest sustainability. The latter remain on the whole unidentified and neglected by conventional science.

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