



Agricultural land use pattern dynamics in the Sudan–Sahel—towards an event-driven framework

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Abstract

While addressing the issue of field encroachment and land use pattern changes in the desert margin regions, the paper proposes to develop a model which recognises land use pattern changes as event-driven. The picture that underpins development efforts and policy papers for environmental improvement in the Sudan–Sahel region often describes changes in agricultural landscape systems as a unidirectional expansion of fields onto marginal land in response to population pressure and resource degradation. It is proposed that models of land use pattern trajectories as well as of resilience of land use systems have to recognise a strong random element related to unforeseeable events. © 2001 Elsevier Science Ltd. All rights reserved.

Keywords: Land use; Population pressure; Field encroachment; Trajectories

Introduction

A priori judgements about the importance or character of man's use of land dominate official documents, such as international conventions and National Environmental Action Plans, which underpin environmental and natural resource management politics. Although, conventional wisdom about pertinent environmental issues has moved substantially in the scientific community, this has not always had a significant bearing on the political documents.

In this perspective, the present paper deals specifically with the issue of changing land use pattern, i.e. with the spatial structure and extent of various land use categories related to the human utilisation of land. It does so by first presenting briefly theories that concern the process of land use changes, mainly emphasising those that include spatial aspects in terms of land use patterns.

The second part of the paper exemplifies, drawing on case studies from Burkina Faso, how the spatial pattern of land use, including the use of different landscape units may change suddenly and in response to unpredictable events.

In the conclusion, it is proposed that more attention is paid to the spatial aspects of resource management in land use systems and the extent to which events play a major role in forming the land use pattern trajectories.

Background

During the latter half of the twentieth century, the majority of global land cover changes have occurred in the tropical regions, among these, the Sudano–Sahelian zone. Such significant alterations of man's physical environment are environmentally important in as much as they impact the land's resilience and capacity for sustained future use (Turner II et al., 1995). They may be caused by natural processes (Tucker et al., 1991), but increasingly important is the impact of human land use aimed at producing agricultural products.

Sweeping generalisations, related to possible interference between socio-economic alterations, human use of resources, degradation of the environments and negative feedbacks that exacerbate the climatic stress (Copan, 1974; Hare, 1985), have been brought forward to describe the development trajectories in contemporary Sudano–Sahelian agricultural landscapes. They suggest, for example, that cultivation expands onto marginal land (Scott, 1979; Vierich and Stoop, 1990;

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Snrech, 1994; Webber, 1996); that increased degradation of upland fields leads to subsequent abandonment (Vierich and Stoop, 1990); that demographic pressure causes decreases in fallow length and leads to a vicious circle of degradation (Greenland et al., 1994), etc.

The global validity of conventional wisdom within the area of land use and the environment has been questioned (Tiffen et al., 1994; Leach and Mearns, 1996; Raynaut, 1997; Adams and Mortimore, 1997; Marcussen and Reenberg, 1999). It is still more frequently argued that while global scale population growth is one of the major driving forces of environmental change, there are significant local variations in the interrelationship between people, food production and environmental change (Uitto and Ono, 1996) and that no simple relation exists (Mazzucato and Niemeijer, 2000). Several key issues need to be revisited in a multidisciplinary context to understand the prevailing resource management strategies and the most probable directions of future development. One important issue to address is land use pattern dynamics with the aim of understanding which forces drive land use changes in various environmental, socioeconomic and cultural contexts. This, in turn, will be a valuable basis on which to develop a much needed framework for conceptual models that are capable of extrapolating and generalizing local observations to expected trends at the regional, national and global level (Scoles et al., 1994).

This article exemplifies how and why events of various types, such as climate change, shift in ethnical dominance or in social relationships, alteration of gender roles, etc, may lead to new conditions that greatly influence the directions of change. Thus, agricultural landscape pattern dynamics may be better described as a result of a series of *event-driven alterations in directions of change*.¹

Land use patterns—theories about change

A comprehensive theoretical literature addresses the process of change in agricultural systems as regards intensification and parts of it also concern spatial aspects in terms of land use patterns.

The role of population growth has been given much attention, not least in relation to land use pattern changes. Simple cause-impact relationships between increased population size, agrarian change or eventual

collapse of the ecological balance dominate. Malthus (1960, p.1798, 1803) presented a crisis scenario theory, in which he argues that population, if left unchecked, grows more rapidly than food production, and Ricardo (1817) added that land, being limited, would provide the prime impediment to agricultural growth. Along these lines, the neo-Malthusian school of thought sees population growth as leading to irreversible degradation or depletion of resources (e.g. Meadows et al., 1972; Scott, 1979). Demographic pressure is believed to lead to cultivation of agriculturally marginal land or to degradation and unsustainable use of existing fields.

More optimistic theoretical points of view have been emphasized by several researchers following Boserup's theory concerning the relationship between population growth and agricultural change. Boserup (1965) proposed that the increased need for food and land scarcity caused by population growth were countered by an intensified use of technologies in which more labour was used in conjunction with land improvement technologies. Thus, the increase in population density or land scarcity could trigger agricultural intensification contrary to the crisis theories suggested by the Malthusian school. Recent research has renewed the interest for Boserup's theories due to its usefulness in explaining why population pressure does not in all cases necessarily lead to degradation. Overall, however, it must be acknowledged that it is difficult to translate these global theories into operational characterisations at the local level (Serpantié, 1993). Evidence has been brought forward which documents that there is no simple relationship between population growth, land scarcity, expansion of cultivated land, and degradation (e.g. Tiffen et al., 1994; Christiaensen and Tollens, 1995; Snyder, 1996; Adams and Mortimore, 1997; Mazzucato and Niemeijer, 2000).

Bilsborrow and Ogendo (1992) propose a conceptual framework wherein the population driven changes in land use are seen to be manifest in various forms, including land-tenure arrangements, intensification of agriculture and extension of agricultural land. Two parameters, expansion of cultivated land and intensification of land use practice, are keys in these theoretical considerations of agricultural change. They suggest that there are four phases involved in the responses of land use to population growth, which are, however, sometimes consecutive, concurrent or even cumulative. They propose that the effects of population pressure are likely first to be felt through changes in tenure arrangements. The second phase of adjustment is expansion of land. This occurs when communities do not have a sufficient stock of land in their immediate area, but where there remains land, which is both arable and physically accessible. The second phase may occur simultaneously with the first or the third phase. These first two phases may or may not be accompanied with radical changes in land use practices.

¹ It should be noted, however, that the term event-driven refers only to the type of change (as opposed to gradual change). In other words, in spite of the linguistic resemblance, it is not referring to the 'event ecology' school of thought proposed by Vayda and Walters (1999) as an alternative to political ecology as a means to 'avoid erroneous claims about the environment on the basis of preconceived theoretical ideas or agendas' or 'prejudge political factors to be most important' (p. 177).

The third phase is adoption of new technologies, the distinctive feature being intensification and an increase in land productivity. The last response in the population/land use continuum, the fourth phase, involves a fertility reduction. It is seen as related to phase two and three in the sense that (a) out migration is an alternative to fertility reduction and (b) intensification makes larger family units possible and even desirable.

Geographic expansion has also in other contexts been stressed as being perhaps the most direct reaction to the population pressure caused by population growth or a declining resource base (Netting, 1993). If vacant land is available or if land is obtained by conflict or forcing out other users, the population density will remain low and allow the cultivators to continue their labour-efficient land use practice.

It has increasingly been acknowledged that, though farmers are rational (Richards, 1988), they do not run a business but rather manage a household. Their land use strategies are based on risk minimizing practices, but they are also influenced by other factors such as ethnic traditions (Claude et al., 1991; Reenberg and Paarup-Laurson, 1997) and social status and preferences (Berry, 1993; Snyder, 1996; Mazzucato and Niemeijer, 2000). Therefore, the susceptibility of land use to external changes cannot be completely understood without considering such aspects as well. Furthermore, issues such as state politics, market incentives, climate variations, and access to land and water resources are generally acknowledged factors determining the trajectory of land use change (Kull, 1998).

What is missing is a means to link this multitude of explanations to an overall understanding of the process that leads to transformation, an approach that handles a variety of intertwined, yet distinct explanations. Single theory explanations may have their persuasive moments, yet explanatory theories can be more usefully regarded as complementary rather than exclusive (Turner et al., 1993). Following this line of thought, Kull (1998) suggests adoption of White's (White, 1961; Wescoat, 1987) 'range of choice' concept as a heuristic device of organizing the variety of ideas which are required in a plural explanation. Although originally developed for water resource management, it is seen to provide a useful way to organise contributions from various theories of land use changes. The 'range of choice concept' is based on the assumption that a person's use of resources reflects the range of opportunities he or she possesses. The practical range of choices available is conditioned by ecological, political-economic, cultural, market, perceptual, and social factors. Although the 'range of choice' has been criticised for lacking a social theory to address the mediation of individual action by social context and political economy, Kull (1998) sees it as a useful device to link the contributions of relevant theories, including theories on social change. Thus, the

range of choice is employed as a tool to come to terms with the whole picture of human caused transformations.

With this pragmatic definition, the 'range of choice' may contribute to provide a framework for combining factors that are dynamic—a moving target (Berry, 1993)—in the sense that they are constantly changing, moulded through the processes explained in political-economic, ecological, social and other theories.

The fact that the structure and function of an agricultural landscape can be perceived differently at different spatial and temporal scales adds further to the theoretical and analytical challenge (Reenberg, 1999), as supports the observation made by Mortimore (1995, p. 63) on a Northern Nigerian case—"that the regional association of rising rural population densities with agricultural expansion hides sharply contrasting experiences at micro-scale". Thus, perception of land use dynamics should include a hierarchy of spatial scales (Reenberg, 1996). Scenarios for land use change at a national or continental scale will be a valuable contribution to the analysis of global environmental change. On the other hand, these changes have to be seen as a result of a diversity of parameters and processes that can only be analysed at a much finer scale.

Theories on land use changes seldom reflect the potential impact of gender specific priorities on land use patterns, in spite of the fact that gender segregated agriculture is common in much of West Africa. Households consist of several production units with different status which affects labour allocations (Whitehead, 1984; Saul, 1993; Nyerges, 1997; Breusers, 1998; Smith and Chavas, 1999). Frequently, the male household head controls a 'communal production unit' for which he can claim the labour of his dependants, but in addition, the household consists of a number of 'personal production units' controlled by wives and junior males. Land use decision making is thus separated into different spheres, and household members do not necessarily share the same production objectives or pursue a single strategy. The sub-units within a household are related in a complex, sometimes gender specific, set of obligations, rights, and responsibilities (Moore, 1992; Kabeer, 1994; Berg, 1997). Thus, gender specific aspects may have a considerable bearing on contemporary pattern and not least on susceptibility of the land use pattern to changes in the society at large. Therefore, they deserve to be taken into account in theoretical thinking.

Putting light and shade into the explanation of agricultural landscape evolution

Based on empirical experience from the Sudano-Sahelian region, the following will discuss trajectories of

land use changes, and the appropriateness of understanding changes as abrupt and driven by events as opposed to evolving gradually will be considered.

The four case studies that are used in the following as illustrations are located in two different agroecological zones in Burkina Faso (Fig. 1). The Sahelian zone is characterized by its low and irregular rainfall, with a mean annual precipitation in the case villages in the order of magnitude of 300–400 mm. The landscape consists of a very flat ancient pediplain on which longitudinal dune systems have been superimposed during two or more drier periods of time. The soils on the pediplain are heavy, sometimes lateritic; they are often virtually impossible to cultivate with simple tools. The dune bands, however, have attracted millet cultivators because of the relative ease of cultivating their light soils. The agricultural land use systems can briefly be characterized as a combination of pastures and cropping, the latter being dominated by millet and sorghum. The Sudanian agroecological zone has a larger precipitation (the average for the study region from 1922 to 1992 being 904 mm), yet, still with considerable variations from one year to the other. The land use is dominated by cultivation, however, cultivation intensity varies significantly within the region (from 10% to 74% according to Hansen and Reenberg (1998)). The main

agricultural activities are millet and sorghum cultivation, supplemented by cowpeas, groundnuts, peas, rice and a variety of minor crops without any significance with regard to acreage cultivated.

Generally, it applies for the Sudano–Sahelian zone that under conditions of increased demographic pressure, subsistence farmers face a reality of increased demand for staple food, possibly even while experiencing declining yields. Although, migrant work or relations with the pastoral sector do provide supplementary sources, the majority of the food supply still has to be provided from the farmers' fields. Thus, farmers' potential response to situations of increased population or declining yields can be largely divided into two pathways (Fig. 2): they can expand field acreage (change land use patterns) or intensify cultivation on existing fields (change land use practice).

Farmers' response options—and the final land use choices made—are highly influenced by a range of factors. Several researchers (i.e. Sutter, 1982; Toulmin, 1992; Tiffen et al., 1994; Bolwig, 1999) underline for example, the great importance of labour availability as hinted in the diagram. What is also important to note, however, is that key factors which may be subject to sudden change influence farmers' strategies, e.g. climate, cultural norms, tenure rights, gender responsibilities,

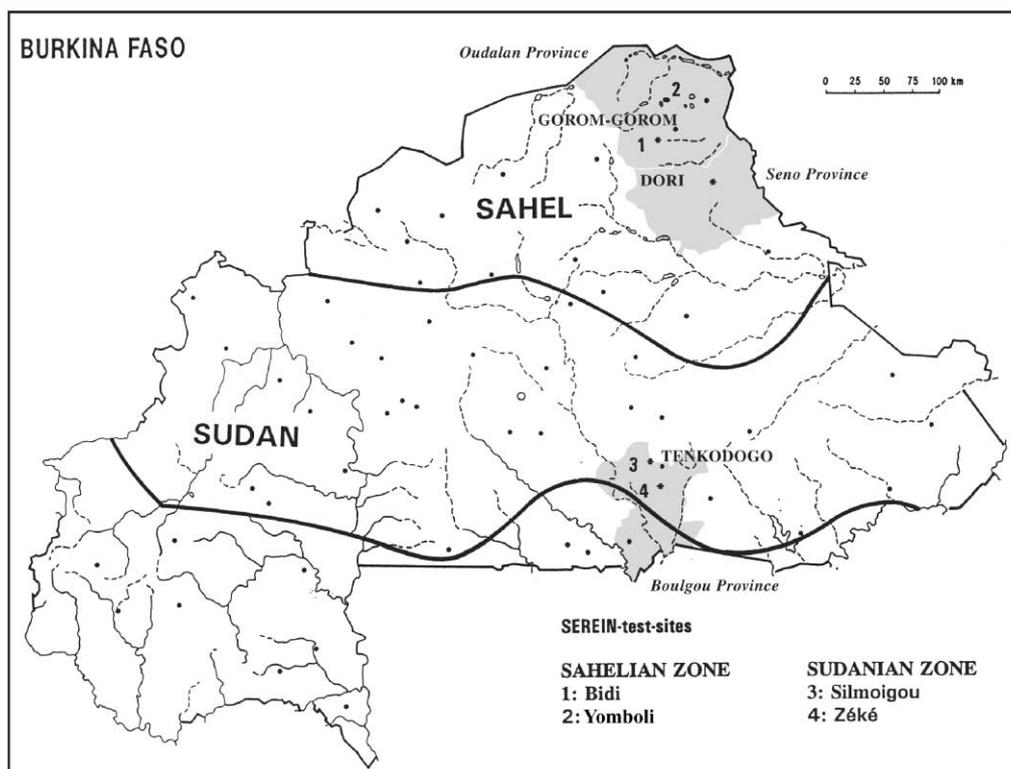


Fig. 1. The case studies used as examples in this context are located in two different agroecological zones in Burkina Faso. The map indicates the approximate location of the study villages.

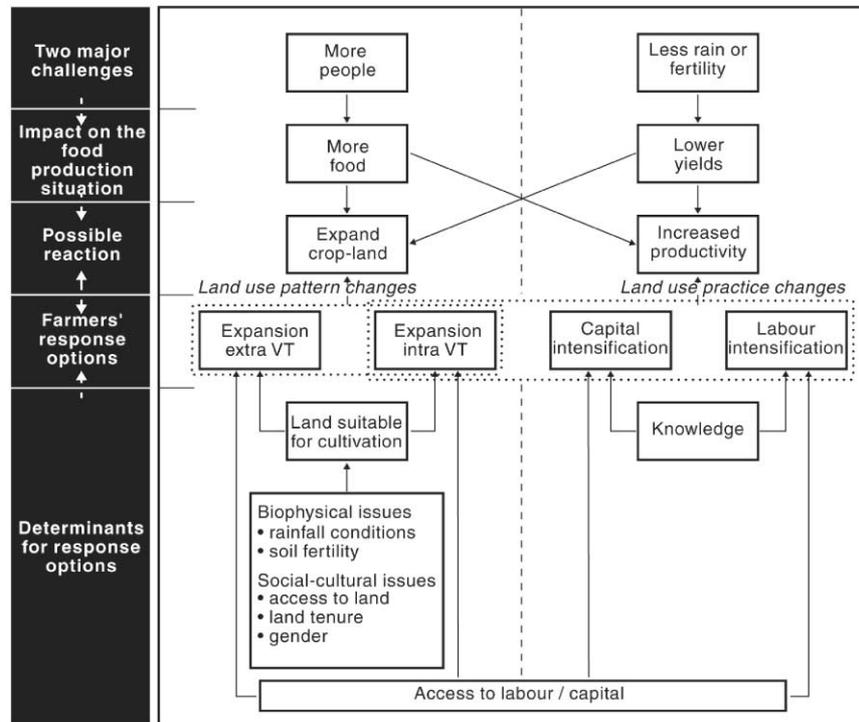


Fig. 2. Farmers' response options to ensure food security vis-à-vis alterations in land use practice and land use patterns. (VT = Village Territory).

etc. This will be further discussed below, yet with emphasis on the spatial aspects, i.e. on land use patterns.

Tenure and land use

One obvious premise for land expansion is that idle, uncultivated land must be available to the farmer. Whether this is the case is, however, influenced by social and cultural factors which enable and constrain access to land. Most African societies operate with a notion of 'first occupants' and their descendants who enjoy the right to use and allocate land, and the notion of 'latecomers' or 'strangers' and their descendants who depend on the benevolence of the first occupants to access land (Place et al., 1994; Le Roy et al., 1996). Consequently, when a piece of land is accessed by someone who is not a descendant of the first occupant, a transfer transaction takes place. This transfer is, on the one hand, essential to the flexibility of African land tenure systems; on the other hand it is a source of conflict due to its ambiguous nature, and finally, it is a potential cause for changing situations.

Reenberg and Lund (1998) have investigated how to access land, can have significant bearing on land use dynamics on the local scale, based on a case study of the village of Silmiogou, south-eastern Burkina Faso. Compared to other villages in the region, there is a general lack of idle land, yet Silmiogou has had a unique

opportunity with respect to access to land. They have a close "family-friendship" relation to the neighbouring village which had given them to access idle land in the bush that became more attractive after the elimination of river blindness (Baldry et al., 1995; McMillan, 1995). In this way, they have within a short period of time been able to expand their territory by approximately 25%.

The management of land rights in this region is continuously facing change. Tenure regimes change and adapt to circumstances and people jockey for position according to their perception of the circumstances and in anticipation of the future. Hitherto, land resources have been relatively plentiful and the potential conflicts of interest have not erupted. Up until now, virtually all transactions have followed a verbal agreement, yet, recently some farmers in the area have begun to register these transactions in writing. The pattern of land use changes may thus become increasingly influenced by more formally established rights. As opposed to the current situation where labour availability, social relations and distance to the land seem to be the main constraints on land expansion, tenure rights may become a major determinant for land use trajectories.

Cultural dimensions of land use

Ethnic variations are known to be important factors influencing agricultural strategies, and often deserve to

be included as important parameters in regional studies of the agricultural system (Harts-Broekhuis and de Jong, 1993).

Reenberg and Paarup-Laursen (1997) discuss ways in which ethnic-specific perceptions of the natural environment have a considerable influence on the use of land. They study a village in the Sahelian zone of Burkina Faso. Sandy surfaces are almost exclusively cultivated. The older dunes (and the sandy covered pediplain) are best suited for cultivation because of the finer texture of the soils, but also, parts of the younger dunes are cultivated, yet not used to the same extent as the old ones. Several different ethnic groups are present in the region (Claude et al., 1991; Krings, 1980) and the previous division between slaves and masters is still felt. Slaves and the former masters, e.g. Riamibé and Fulbe, often live closely together in the village.

Two important observations were made as regards ethnically influenced impact on land use. The first relates to prioritization of different soil types, i.e. coarse sandy soils vis-à-vis soils with a finer texture. Yields on the coarse soils are generally very low, and the return to labour input thus unfavourable. Considering that labour is the main input factor, limiting the field acreage as well as the sufficiency of manure supplied, a rational strategy to ensure the maximum production would be to invest labour in the highest yielding fields only. However, the Fulbe continue to invest a considerable amount of manpower farming coarse sandy fields with a very low yield. This practice can be related to perceiving agriculture as a secondary economic activity, because Fulbe originally were dependent on livestock. The high evaluation of sandy soils relates to the status of agriculture vis-à-vis pastoralism. According to the Fulbe, agriculture demands hard work which pastoralism does not (c.f. Reisman, 1977). Agriculture is thus associated with the work of slaves. To assert oneself as Fulbe (whether one is Fulbe or Rimaibé) demands a certain distance to hard physical work. The coarse sandy fields demand far less labour for weeding than soils with a higher clay content.

The second observation relates to the factors determining field size. Field size in the Sahel, in general, believed to be closely related to population size (Claude et al., 1991; Guillaud, 1993; Milleville, 1980). A significant difference between the Fulbe and the Rimaibé can be observed as regards cultivated area per consumption unit. This difference is rooted in the access to land. Land is in principle administrated by the village leader, but now in reality, by the defunct institution of village chief, 'jooro'. Different views on availability of land can be observed. According to the Rimaibé, extension into pasture/bush is prevented by the environmental authorities and underutilized areas are not available for cultivation. According to the former 'jooro', there is sufficient land for redistribution, just

as it would be possible with his help to gain permission to extend into pasture/bush area. Traditionally, the land is still considered the property of the Fulbe and positive relations to the former 'jooro' seem essential to the acquisition of new land. Therefore, it is reasonable to believe that the Fulbe have easier access to new land.

Thus, cultural values rooted in ethnic differences play an important role for land use structures and development. Acreage cultivated cannot be explained entirely as a simple consequence of population size and need for food. Ethnically, determined perceptions and values have significant impact on the availability of and demand for land. Changing ethnic dominance could therefore be an important driver for change in land use strategies.

Rainfall and land use

The issue of field expansion and reallocation in semi-arid regions can serve to throw light on ways in which land use develops under conditions of changing opportunities which emerge as results of climatic modifications.

Mazzucato and Niemeijer (2000) stress that climatic changes can cause changes in land use practices which, however, have to be interpreted with care if false conclusions are to be avoided. They observe in their case study from eastern Burkina Faso that higher situated fields are being abandoned because the reduced rainfall no longer allows sufficient yields. In other words, the reallocation of fields in recent years from uplands is a result of an adaption to changing environmental conditions in terms of declining rainfall rather than a result attributable to declining soil fertility due to decreasing fallow as suggested by Vierich and Stoop (1990). Thus, climatic events override possible soil degradation as a major driver for land use changes in this case.

Reenberg et al. (1998) likewise document that land use pattern has fluctuated significantly within the last 50 years as documented from a series of aerial photos, satellite images and GPS measurements carried out in the field. While the statistics, in general terms reveals that the expansion of the cultivated area corresponds approximately to the population increase, these quantitative estimates do not support the view that farmers compensate for degraded soils and declining yields with larger fields. The area has expanded in size, but just as important to notice is the change of field location from one landscape unit to another.

The reallocation of fields may be seen as a response to the changes in precipitation. The decrease in rainfall has been associated with a concentration of the cultivation of the sandy soils on the dune. These soils have a comparative advantage in dry years (Reenberg, 1994). The overall change can be read from the aerial photos

and satellite images. In 1945, the cultivation was entirely on the pediplain. From 1945 to 1955, fields were moved to the dune and the piedmonts in the western part of the territory, yet a few fields on the pediplain were still cultivated in 1955. From 1955 to 1986, the area on the dune above Mare Yomboli was cleared and used for cultivation and fields on the pediplain were abandoned. The expansion on the dune continued until present. Since 1991, farmers have tended to diversify their cultivation by cropping several land units (dune and pediplain) and thus, have taken advantage of the variation in the potential of different soil types with varying rainfall amounts (Fig. 3).

The impact of rainfall changes on landscape specific priorities exposes why the concept ‘marginal

land’ may lead to simplistic interpretations of the expansion process. The classification into marginal and non-marginal land presupposes that one type of land can unambiguously be perceived as more suitable than the another. This may change rapidly, e.g., as a result of rainfall changes. Thus, changes in land use strategies results not only in a simple expansion of fields to new and less attractive land. They are influenced by a more refined adaptation strategy by which the farmers try to ensure the best possible outcome of their labour input. The net result in the present case has been an expansion of land with an important element of reallocation of fields from one soil type to another driven by climatic events.

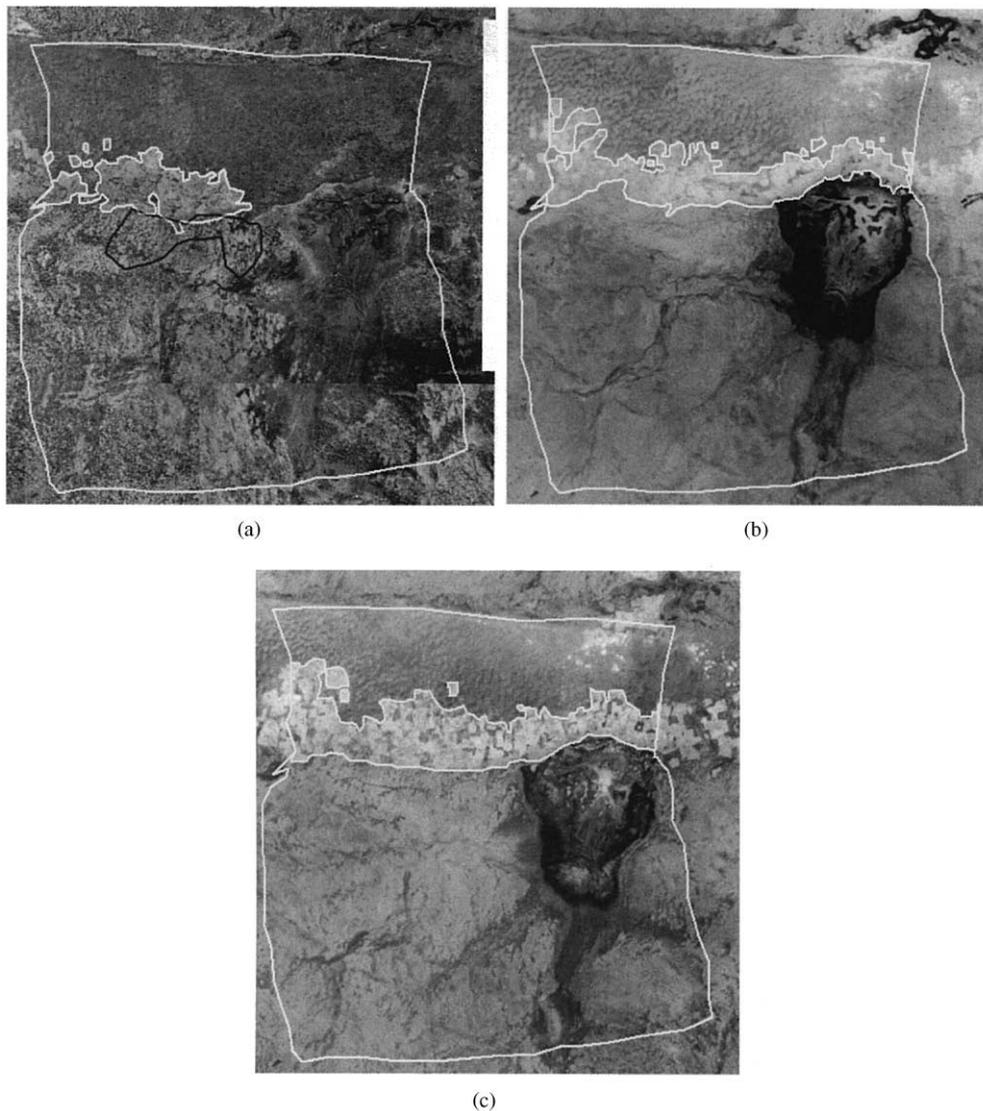


Fig. 3. Shows the territory of Yomboli in Northern Burkina Faso and the location of cultivated fields in the year 1945 (a, black line); 1955 (a, white line) 1986 (b) and 1991 (c). The field limits are determined on the basis of field measurements (1945), interpretation of aerial photos (1955) and SPOT satellite images (1986 and 1991). The background is a mosaic of aerial photos.

Gender and land use

Minor, although significant, priorities in land use patterns at the micro-level are related to women's farming activities.

A number of case studies, regarding the spatial location of women's fields, from Burkina Faso (Hemmings-Gapihan, 1985) and Cameroon (Berg, 1994, 1997) indicate that a household head may allocate marginal land to his dependants either on the outskirts of the village or on exhausted land, which he does not want to cultivate himself. This picture of women being marginal farmers does not apply in all cases. Thorsen and Reenberg (2000), for example, find that women are not disadvantaged in terms of spatial marginality. Their fields are not located further away from the compound than men's and field histories reveal that some of the younger women have opened new fields within the last few years; they are not just cultivating abandoned household fields.

Women are more adversely affected by the transport than men are, in as much as women walk back and forth, whereas most men use cycles. Moreover, they have less direct access to labour saving technologies such as ploughs and carts. Finally, women need to combine work on the household fields, possibly on their husbands' personal fields, on their own fields, and in the domestic domain. In spite of this, the results show that women's role as land users, even in male dominated agricultural systems, seems to be underestimated in terms of their impact on the overall pattern.

Significant, event-driven changes in gender specific land use practise are reported in Hansen and Reenberg (1998). The recent drier conditions have forced the female farmers to turn away from their traditional vegetable fields in the valleys because these were no longer suitable for production due to lack of water. A concurrent shift in the economy that ensured more favourable market conditions for groundnuts has in combination with these deteriorating environmental conditions inspired new, gender specific land use strategies. Women have, triggered by a change in rainfall, become much more prominent land users in terms of acreage. These changes will have an impact on the overall future development trends.

Women are generally disadvantaged in terms of capacity to expand and develop the agricultural production. They have less physical strength, limited access to labour from other parts of the family, the need to combine agricultural work with duties in the household, and less access to labour saving technologies like ox ploughs, carts, bikes, etc. Thus, productivity is hampered compared to that of the fields cultivated by males. Nevertheless, in a changing society with emerging new opportunities for work and marketing, it is

worthwhile to focus also on gender specific conditions for future change.

Conclusions and perspectives

A main message which can be drawn from the above is that predictions of land use pattern trajectories and evaluation of resilience of land use systems has to be based on a multidisciplinary analysis of the land use systems that recognizes a strong random element related to unforeseeable events.

Many documents that underpin the development discourse concerning Sahelian environmental issues assume that an unambiguous linkage between population pressure, land use, and adverse environmental impact is proven beyond any need for debate. In spite of the marked attention to the fact that the global validity of conventional wisdom within the area of land use and the environment may be questioned, the relatively weak empirical foundation impedes improved scientific understanding of land use pattern situations (Mortimore, 1995; Snrech, 1994; Raynaut, 1997). Substantial changes in land cover and land use are referred to, although systematic studies which deal with spatial aspects are still scarce in spite of the growing evidence concerning other aspects of agricultural land use changes in Africa (Wiggins, 2000).

In general, land use pattern changes may not be simple to explain and predict (Naveh, 1989). Even in subsistence agricultural systems, changes in the land use pattern should not only be analysed and understood as a relationship between population pressure (or need for food) and the potential of the natural resources. Where land is still available, invention, change, adaptation and other elements of development take place, thus indicating that population pressure is not the only stimulant for change (Brouwers, 1993; Mazzucato and Niemeijer, 2000). Land use patterns have a random element. The land use pattern might respond to short-term fluctuations in a large number of driving forces and such conditions may change any time (Brouwers, 1993).

This makes a strong case for looking at processes of field encroachment in another perspective than that of a unidirectional, continuous change. Recognizing that the links between ecological constraints and human development are not linear (Meertens et al., 1996), it may be useful to confront empirical evidence on land use patterns changes with accepted models of change; not necessarily with the aim of creating new models, but in order to avoid having simplistic myths survive and persist as the grounding for environmental counselling.

When doing this, attention should be made specifically to two issues: *event-driven alterations in directions of change* and *landscape and spatial-specific aspects of change*. The importance of sudden events has been

argued for in relation to rainfall changes. But also, factors related to the human dimension of change could be put forward as good examples. Reallocation of population caused by migration can, for example, lead to the introduction of new agricultural habits, larger population densities, new cultural rules etc. which, in turn, will alter the basis for land use decisions.

Some of the examples given in the current context illustrates that geographical space, in terms of a landscape specific view on land use, can act as “a marvellous resource allowing new insights from information that might otherwise be regarded as unstructured and unintelligible” (Haggett, 1990, p. 68). Looking at landscape specific changes can help to disclose important traits of land use strategies that are otherwise disregarded, such as reported in the Yomboli case. The idea of tracing the use of a specific unit of land through history offers a simple, but efficient means of decoding spatial messages and translating them into important information about the dynamics of the agricultural resource management strategies (Reenberg, 1999). Garrity and Augustin (1995) have drawn attention to the fact that the development of a tool to effectively capture the evolutionary trends in agricultural systems has been neglected. Landscape specific land use sequence analyses can make a useful contribution in that context, albeit not without skilful combination with other approaches to land use dynamics that take into consideration socio-economic factors (Reenberg, 1998).

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