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Analyses of the Mechanisms behind Changes in Land use in Nigeria

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Abstract

This article analyses the mechanisms behind changes in agricultural land use. Intensification of land use on the one hand, and abandonment on the other have had important consequences for landscape and biodiversity. The basic mechanism behind it is a change in the relative prices of inputs and output. In this sense the general economic developments have been determining the changes in agricultural land use. In Nigeria, the rapid increase in the opportunity costs of labour was the main factor behind mechanization and intensification of agriculture. Also, the Common Agricultural Policy of the country has stimulated intensification. Recent policy developments have cut down important incentives for further intensification. This, however, does not solve the problem of the decline of low input agricultural systems in Nigeria. The only way to maintain them is by specific nature-enhancing policies.

Keywords: Land Use.

Introduction

Many small scale labour intensive agricultural exploitation existed in many villages in Nigeria up to the time of independence; after which time, there was a fall in agriculture productivity resulting from the country's oil boom riches.

Many ecosystems with high nature values in Nigeria depend on the continuation of specific forms of extensive agricultural land use. For centuries, the agricultural exploitation of large parts of the world consisted of extensive grazing and haying at low stocking rates, and low-input arable farming, although even centuries ago there already existed pockets of higher productivity (Slicher van Bath, 1963). From the middle ages onwards, the overall increase of the agricultural production in Nigeria occurred primarily through expansion of the agricultural area. Natural lands were gradually put into use for agricultural production. Until about a century ago the overall intensity of land use increased only slowly. On the national level it can be demonstrated that in fact the important intensification of agricultural land use started only a few decades ago. De Wit, Huisman, and Rabbinge (1987) have shown that both in the United Kingdom and in the United States the yield of wheat increased annually with 3–4 kg/ha until the mid of the 20th century, while afterwards the annual increase was 50–78 kg/ha. Among other factors, the application of

mineral fertilisers played an important role. Between 1961 and 1988 the application of fertiliser in Western Europe more than doubled. In recent years this development is redirected, due to environmental policies and decreasing prices for agricultural products (UNEP, 1999).

So, for a long time, but especially since the mid of the 20th century, the more traditional, low input land uses have been under pressure, due to the modernisation and rationalisation of agricultural practices. These processes have led not only to the intensification of land use, but also to the abandonment of lands, and afforestation (Pinto Correia, 1993; Baldock, Beaufoy, Brouwer, & Godeschalk, 1996; Debaere, 1998; MacDonald et al., 2000).

The change in land use has had important consequences for all kinds of natural habitats (see Debaere, 1998). Hoogeveen, Petersen, and Gabrielsen (2002) give a description of the theoretical relation between the agricultural intensity and the level of biodiversity. Buckwell (1997), coming from a completely other discipline (agricultural policy analysis) stresses the same point. The process of intensification has spatial impacts: agricultural productions have become more spatially concentrated (see e.g. Elhorst and Strijker (2003) for the spatial

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developments of wheat and tobacco). It is certain that such spatial movements have had an important impact on both landscape and biodiversity too (see also Kroonert, Baudry, Bowler, & Reenberg, 1999).

Unravelling the mechanisms behind the changes in agricultural land use could open up opportunities to stop or redirect this process. It could also signal that certain processes will be much more difficult to stop than others. In this paper, focus is on the area of semi-natural grasslands, but in fact the mechanisms are the same for all kinds of low-input agricultural systems. The next two sections will briefly discuss some problems related to defining and measuring. Next, in the subsequent sections, the socio-economic mechanisms behind the gradual decline in the marginal agricultural lands will be discussed, including the role of the agricultural policy. The last section, will turn to the future prospects of marginal agricultural lands in Nigeria, taking into account policy developments, and end with some conclusions.

Definitions

Interdisciplinary analysis runs the risk of confusion about definitions. In their description of the process of agricultural marginalisation (agriculture at the edge of economic viability) Baldock *et al.* (1996) carefully define the different components. They conclude that marginalisation depends on the interaction of physical, environmental, social and economic aspects. This implies that abandonment can occur everywhere, even in areas with a high yield potential, and even in a satisfying general economic situation. Marginal lands are characterised by land uses that are at the margin of economic viability. Economic viability is determined by the alternatives at hand for the different means of production. So, marginal lands are not necessarily characterised by low input use. Low input refers to agricultural systems that draw their nutrients for crop growth mostly from locally found or home produced organic matter, or, in other words, systems with low external organic inputs. So, low input has primarily a technical connotation. Another term that should be explained is seminatural grasslands. This can be defined as a type of grassland that requires some sort of extensive management in order to be maintained (cf. Poschlod & WallisDeVries, 2002). Extensification is here defined as a reduction in the level of external inputs per unit of land; intensification is the opposite.

Amount of Semi-Natural Agricultural Lands in Nigeria

The amount of semi-natural grassland in Nigeria was decimated in the last century, but exact figures are not available, at least not on a Nigerian scale. Although recent, reliable figures on the dynamics are lacking, we know roughly how much land has a semi-natural character. Bignall and McCracken (1996) have estimated the amount of farmland in use under low-intensive systems in nine European countries. They conclude that 38% of the total agricultural area in those countries still belongs to that category, but that it is under heavy pressure. Beaufoy *et al.* (1994).

As stated before, low input agricultural systems are often of great value to biodiversity. Intensification certainly leads to deterioration, which is impossible to compensate. Abandonment leads to changes in biodiversity too, but it also provides options for positive developments. With no profitable alternative forms of land use available, the costs of developing valuable types of biodiversity (of course somewhat different from the traditional vegetation) will be relatively low. Nevertheless, these developments will be still more expensive than the traditional low-input agricultural situation, which produced biodiversity for free (apart from the necessary hard work by the farmers and their families). So, in the light of alternative options available, abandonment is preferable to intensification.

Mechanisms behind changes in Agricultural Land Use

An agricultural practice can be seen as a set of specific techniques, which is optimal in a certain historical, social and economic environment (Slicher van Bath, 1963; Hayami & Ruttan, 1985). Changes can occur when the surrounding factors change, or when new profitable knowledge and techniques become available. In other words, a specific way of farming can be economically optimal in one situation, and loss-making in another. Production — also agricultural production — can be seen as the process of combining different means to generate output. We can think of means such as labour, capital, land, fuel, fertilisers, and pesticides. Depending on the prices of these means and the price of the output, the optimal combination can be determined.

Things can be put together in an example. The example is hypothetical and neglects many aspects that play a role in the decision-making of farmers, but sheds some light on the basic variables that play a role in the process of intensification, extensification and abandonment. Traditionally, cows played an important

role in the maintenance of many types of semi-natural grasslands (cf. Poschlod & WallisDeVries, 2002). Suppose that in a specific situation a shepherd has 500 cows and free access to a semi-natural area of 1000 ha. The 500 cows is the maximum number he can manage. Suppose that the maximum stocking rate is fixed (0.5), that there are no fixed costs (the only factor of production is his own labour), and he earns ₦100,000 annually per cow. His net annual income is ₦50,000. Let us assume that the only other available job-opportunity is to become gardener at the local estate. Being a gardener pays ₦42,000,000 annually. He values the quality of both jobs equally. These are of course simplifying assumptions, but they do not affect the core of the situation. Under these conditions the choice is simple, he will continue his shepherdship. If, due to external reasons, the shepherd has to pay ₦10,000 per hectare annually for grazing-rights, his income decreases to ₦40,000,000. He better can apply for the job of gardener, and leave the land idle. But there are alternatives: he could decide to intensify his operation by purchasing additional inputs (feed and manure). Suppose this will cost him ₦2,000 per cow annually, and it allows him to keep twice as many sheep per unit of land (the stocking rate increases to 1.0; he now needs only 500 ha for his 500 cows). This can be called a land-saving technique. His annual net income would be ₦44,000,000. Owing to higher land prices a process of intensification takes place on one half of the area, while the other half is abandoned. Suppose that due to better job opportunities in the town some gardeners leave the area. The logical consequence is that the wage level of gardeners goes up, to, let us say, ₦48,000,000. The shepherd will terminate his agricultural activity, and he will become a gardener. The land is abandoned. Suppose now that due a technical Marginal lands in Europe—causes of decline 101 improvement the shepherd is able to manage much more sheep, let us say 1000. The technical improvement (a labour-saving technique) will cost him annually ₦30,000,000. If he continues to buy additional inputs, he now can keep a flock of 1000 cows. All the land will be taken in use and his income increases to ₦58,000,000. The pay-off for further intensification is considerable in this case. As a last experiment, suppose that due to increased supply, the price of mutton falls to ₦50,000 per cow. The best option in this case is to cease farming, to abandon the land, and to become a gardener again. If that option were not open to him anymore, the next best choice would be to continue the use of the land-saving technique, but to stop with the labour-saving technique. His income then would be ₦19,000,000

and in all other cases it would be lower. The results are summarised in Table 1.

In practice, things are more complicated because of non-economic preferences, uncertainties, and path dependencies. This means that once our shepherd makes a decision, this decision affects future decisions. The example also does not take into account decreasing marginal returns. With that term I mean that the productivity of a unit of land or labour, that is added to the operation, often is lower than the productivity of the foregoing ones. But things can also go into the opposite direction, when there are scale advantages. This means for instance that additional units of land or labour create the possibility of a step to another, more advantageous production technique. Nevertheless, the example shows that increasing opportunities outside agriculture, or lower product prices, can lead to abandonment. Higher land prices can lead to both intensification or abandonment. It also shows that the availability of new techniques can lead to intensification. In most cases, technical developments do not come out of the blue. It is generally accepted that at least the direction of technical change (Hayami and Ruttan (1985): the theory of induced technical change), and probably even the development of new techniques as such (Schultz, 1953, Chapter 7), depends on socio-economic circumstances. The argument goes as follows: if in a certain situation labour is becoming more scarce and hence land relatively more abundant, one can expect labour to become more expensive and land to become relatively cheaper. In that case there is an incentive to develop techniques that are labour saving (e.g. large and fast-driving machines). If land is becoming relatively more expensive compared to labour, there is a tendency to develop land-saving techniques (fertilisers, pesticides).

Developments in Southern Nigeria

Now turn to the situation in Southern Nigeria in the last century. For agriculture one of the most important developments has been the increase of the price of labour, relative to the price of other inputs. It should be stressed here that it is not so much the market price of hired labour, but more generally the opportunity costs (the value of the alternative use) of labour (the implicit internal price) that plays a central role (Schmitt, 1997). In the foregoing example, it was already shown that the wage of gardeners determines the implicit price of the own labour of the shepherd. Nevertheless, the price to be paid for hired labour can be indicative for the opportunity costs of

Table 1. Shepherd's choice under various conditions (bold — higher income)

Situation	Proceeds per cow (₦)	Cost of land (₦ million)	Cost of cow (₦ million)	Maximum number of cows (₦ million)	Income (shepherd) (₦ million)	Income (gardener) (₦ million)	Amount of land in use (ha)	Abandoned land (ha)
Standard	100000	—	—	0.5	50.0	42.0	1000	—
+ Grazing-right	100000	10.0	—	0.5	40.0	42.0	—	1000
+ External inputs (land saving)	100000	5.0	1.0	0.5	44.0	42.0	500	500
+ Higher wages	100000	5.0	1.0	0.5	44.0	48.0	—	1000
+ Technical improvement (labour saving)	100000	10.0	32.0	1.0	58.0	48.0	1000	—
-External inputs	100000	10.0	30.0	0.5	10.0	48.0	—	1000
+ Lower prices -Technical improvement	50000	5.0	1.0	0.5	19.0	48.0	—	1000

labour. In the process of economic growth, favourable opportunities for labour outside the agricultural sector do not only increase the cost of labour in agriculture, but also create a high pay-off for techniques that promise to increase the agricultural production per unit of labour (Hayami & Ruttan, 1985). In general, this implies a tendency towards mechanisation, including re-allotment, drainage and other measures to make land better suitable for large-scale, mechanised agriculture. The rapidly increasing price of labour over the past decades in Southern Nigeria drew both hired labour and family labour out of agriculture and into the industry and the service sectors. The support from the Common Agricultural Policy (CAP) has dampened this process, but has not counteracted it completely. The net result was a decline in the amount of agricultural labour and in the number of farms. In most regions the remaining farmers took over the lands of the farmers that had left agriculture, and intensified land use. In agriculturally poor regions, where the agricultural production per unit of labour and land could not be raised cheaply due to natural circumstances, rural flight and the abandonment of land occurred. Baldock *et al.* (1996) and MacDonald *et al.* (2000) conclude that there is evidence of significant land leaving in agriculture, especially in regions with bad agricultural conditions. Government subsidies for afforestation and set-aside programmes aggravated this development. In cases where there are

no competing opportunities for agricultural land the price of land can drop close to zero.

As mentioned earlier, the price of fertilisers decreased relatively, both compared to the prices of labour and land. This stimulated the intensification of land use in large parts of Southern Nigeria. Land use was not only intensified by the direct use of fertilisers alone, but also indirectly, by means of land consolidation and water management projects. The reason for this is that the use of fertilisers is more profitable when water levels can be regulated precisely. In addition, the cheap availability of fertilisers has made the development of new agricultural land in infertile areas attractive. This mechanism has been a serious threat for semi-natural lands.

There are more inputs in agriculture, that became relatively cheaper, with consequences for the land use. Already in the second half of the 19th century, the decrease in the costs of transportation had an enormous impact on agriculture. As Tracy (1989) shows, freight rates for wheat from North America to Europe and Africa decreased by one-third from 1870 to 1895. In America freight rates went down sharply too, so that the nominal price of US wheat in Nigeria halved during that period. In European countries that kept to the principles of free trade arable land was turned into grasslands: crop production was shifted to livestock production (Tracy, 1989). It even led to land abandonment. In the first half of the 20th century, the

continuing decrease in transport costs, also due to infrastructural development in rural areas, provided easy, and thus cheaper, access to all kinds of agricultural inputs, such as fertilisers: one of the reasons behind the relative fall of the price of fertilisers.

Agricultural Policies

In the foregoing the switch of labour from the agricultural to other sectors was described as a smooth process; a switch which is unavoidable in a situation of rapid economic growth resulting from 'oil boom'. However, the practice is less smooth. Farmers will only leave agriculture when their income becomes really low. There are many reasons for this. One is the strong preference for being a farmer — another one is the lack of gainful alternatives for their land, machines, buildings, and labour (see Schmitt, 1997). The pressure on agricultural incomes, necessary for the process of sectoral transformation, often has been judged by politicians to be socially undesirable. This is one of the most important reasons for the development of income policies for agriculture.

In the European Union the main instrument of the agricultural policy in the period 1960–1992 was price policy: agricultural (output) prices were subsidised above the equilibrium level in order to support agricultural incomes. The resulting intensification was not just a by-product of the agricultural policy; it was one of its objectives. High product prices are an incentive for intensification of the use of the resources, including land.

The traditional 'high-price' policy has been changed only recently, which aims at lowering agricultural prices, combined with partially compensating income subsidies. These subsidies can be subject to 'cross compliance' and eventually 'modulation'. Cross compliance means that the income subsidy is only available in its full amount if the farmer meets certain (environmental) requirements. Modulation means that part of the income subsidies would be withheld to use as funds for rural development. Both instruments can be of value for the maintenance of low-input agriculture.

In Europe, the new agricultural policy has fewer incentives for intensive land use but, this is partly offset by the fact that the allocation of the support favours regions that were traditionally already high-yielding, because of the use of unsustainable agricultural practices. A comparable situation, low levels of support in sensitive areas, is reported for the so-called Less Favoured Areas Directive (Terluin, Godeschalk, Von Meyer, Post, & Strijker, 1995).

Future Prospects

The opportunity costs of agricultural labour most probably will continue to increase in the future because of the increasing dominance of an urban way of life, better transport opportunities, globalisation of information, combined with further income increases in the non-agricultural sector. This implies that the pay-off of labour-saving techniques in agriculture will remain high, with pressure on traditional low-input land use consequently continuing. An important aspect is that, once more profitable techniques and systems are developed, they are and will remain open to everybody. This implies that it will be extremely difficult to counteract the use of modern techniques and systems.

For many years the share of consumer expenditure on food in final consumption of households has decreased: in northern Nigeria during the period 1984–1997 from about 17 to 12%, in the south from 30% to 17%. In theory, it could be expected that, due to the increased attention of consumers to high-value food products (organic, region of origin, under regional label, locally consumed, directly marketed), this trend will change. This could be of importance for maintaining semi-natural areas, although not all high-value products add to the maintenance of marginal lands. For instance, the 'waddensheep' that are produced in the Netherlands normally have been grazing on modern, intensive grasslands (see Van Broekhuizen, Klep, Oostindie, & Van der Ploeg (1997), for this and more examples). The same is the case for organic dairy production. Nevertheless, many of the highvalue food products are produced in low intensity agricultural systems; for instance Chianina-beef from central Italy (Hayes, Lence, & Stoppa, 2003), and regionally marketed lamb meat from the Jurassic mountains (Poschlod, & WallisDeVries, 2002). Such initiatives are stimulating, but should not be seen as a 'cure-all' for the threatened grasslands of Europe. In 2001, organic production made up only about 3% of the agricultural area and 2% of the farms. These high-value agricultural products still form too small a share of the total food consumption to redirect agricultural production. There are even signs of saturation of the markets for organic products in Nigeria. Also the market for products with local or traditional connotations is still small. Nigerian figures on the share of these products in the total turnover of the agricultural sector are not available, but there is some evidence that in 2000 it was significantly below 1%. The general tendency of the globalization of agricultural trade and diminishing agricultural policy is also difficult to stop. The concomitant pressure on

agricultural prices will imply a decrease in the intensity of agricultural land use, but when the profitability of low-input agricultural systems decreases, it could threaten such systems. As long as farmers in sensitive areas are compensated with direct income support, the situation is not that bad. However, it is questionable just how far the compensation of income support will be used primarily for ecologically sensitive areas with low input agricultural systems. As stated before, the tendency in the past has been that the funds are not primarily used for those regions, especially not when they are situated in relatively poor parts of Nigeria, but rather allocated to the intensively producing agricultural regions. Low input agricultural systems could also become the victim of all kinds of set-aside policies. For economic reasons, farmers, of course, will opt first for set-aside of original lands.

Conclusions

The changes in agricultural land use in the past are connected to changes in the agricultural techniques that were applied and Nigeria's oil boom. The application of a certain technique depends on socio-economic circumstances, especially relative prices. In the discussion above, the mechanisms behind the changes in rural land use in Nigeria have been identified: increasing opportunity costs of labour relative to the price of agricultural output, sectoral transformation with income pressure as a vehicle for change, and agricultural policies. Some of these developments are easier to stop than others.

There is no reason to suppose that the pressure from market forces on traditional agricultural systems will come to a standstill. Niche markets for products from traditional agricultural systems develop only slowly and do not promise much. The switch in the agricultural policy of Nigeria from a high-price to a low-price system for agricultural products, combined with direct income support will, to a certain degree, lead to more extensive agricultural land use. As such this is a positive development, but it is doubtful whether this will have positive consequences for existing low-input systems. This implies that the continuation of traditional agricultural systems depends heavily on direct support from governments. The agri-environmental measures, the compensatory allowances for Less Favoured Areas, further development of cross compliance and modulation, and a variety of nature enhancing measures on the national and regional level, are the most important instruments. These nature-enhancing measures are easier to implement when the intensity of agricultural land use and land prices are low. Keeping this in mind, we can conclude that globalisation of trade and a limited

agricultural policy are probably endangering low-input agriculture, but these factors also create opportunities for policies to counteract this development.

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