

RURAL LAND USE CHANGE IN SOUTHEASTERN NIGERIA: EVIDENCE AND ENVIRONMENTAL CONSEQUENCES.

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ABSTRACT

Southeastern Nigeria is an area in tropical Africa that is well known for high population growth rate and crude density, high rate of urbanization and poor agricultural resource base. Evidence has shown that these are the main driving forces for the change in rural land use in the region. However, since land use change will continue to be part of human environment and development, it is proper that the change is not opposed but be adapted in order to gain from the improvements in human welfare that may be associated with it if managed well. Accordingly, proper management of the transitions of the land use systems becomes vital for the sustainable environment and development of southeastern Nigeria. In this regard the author proffers the application of land quality indicators as an environmental management tool for the region against the backdrop of the land use change and the linkages with the environmental degradation in the region.

INTRODUCTION

Southeastern Nigeria, comprising nine states occupies an area of 79,612km². It has a total population of 18,921,922 (1991 census) and an average population density of 238 persons/km². This average however, conceals the true picture, as many localities in the region are known for extraordinary high population densities. According to National Population Commission (NPC) (1998), southeastern Nigeria when compared with other parts of the country is the most densely settled region. Thus, while Okafor (1991) noted that the region is an area in tropical Africa that is known for high population growth and crude densities, Okigbo (2001) observes that some villages in the region have population density of up to 2000 persons/km². In terms of growth, it has been estimated that the region grows at the rate of 3.0-4.3% annually (Okarofo, 2002). This is obviously a very rapid rate of population growth. The high rate of population growth and crude density have obvious and important implications for the land use systems in the region.

Furthermore, Nigeria is generally experiencing a rapid urban expansion and it has been recognized that Nigeria's urban growth rate of 5.5% per annum ranks among the highest in the world (World Bank, 1995a). It is presently estimated that 43.5 percent of the population live in urban centres in Nigeria United Nations Centre for Human Settlements (UNCHS) (2001).

The rapid expansion of urban centres confirms Okoye's (1981) assertion that Nigeria is experiencing urban explosion of the magnitude that could produce the urban imperialistic invasion of the countryside. The urban explosion has its spatial expression in the vast areal expansions of the cities at the expense of rural land. This is because as cities grow larger, an increasing amount of the surrounding land, which may once have been used for agriculture or provided natural habitat for wildlife is taken over for housing, roads, industries and commercial uses (UNEP, 2000).

In many parts of southeastern Nigeria, the same process is taking place: urban land use types displacing rural land uses. Field calculation by Okoye (1981) indicates that the built-up areas increased by an average of 3.5 percent of the whole land area of the emerging conurbation in the present Anambra State. The rate is believed to be much higher now as the urban space is encroaching into rural landscape with alacrity (Okafor, 2001).

The population pressure and rapid urban expansion have resulted in a broad spectrum of human activities in the

rural areas of southeastern Nigeria. These activities are mostly connected with agricultural practices and other land use activities in which urbanization, industrialization, commercial activities, road building and general infrastructural development appear most important (Ofomata, 1998). The spatial expression of these activities on the rural landscape includes dense network of settlements, diversification and intensification of economic activities and dense network of settlement infrastructure. These, coupled with poor ecological conditions of the region have not only resulted in land use change but have also adversely affected the environmental resource quality of the region (Madu, 2001).

Some of the rural environmental problems of the region are land degradation (particularly soil erosion and soil fertility loss), diminishing forest resources and loss of biodiversity. However, land degradation is the most significant environmental problem of the region and has accordingly, formed a major subject matter for a considerable length of time (Ofomata, 1988). In spite of the number of publications, the region continues to experience severe environmental resource degradation.

Following the increasing magnitude of environmental degradation in southeastern Nigeria, Madu (2001) has suggested that its effective check should be regarded as urgent in the planning strategy of the region. However, as stated by FAO (2001) this can only be achieved after proper understanding of their causes, including the related socio-economic factors as a prime requirement for developing mitigation technologies. One positive step as put forward in this paper is to develop and apply land quality indicators to guide research, policy changes and management decisions concerning land use and the environment of the region.

EVIDENCE OF LAND-USE CHANGE

Land as a natural resource has a number of utility values. It can be appreciated for its mineral wealth, agricultural production, its healthy environment for human occupancy or for all these or more attributes (Mbagwu, 1981). This explains why Fischer (1999) describes land use as why and how people work the land and how vegetation cover and soils are affected during the process. Similarly, National Research Council (1999) refers to land use as the socio-economic portrait of a landscape. Also Young (1999) describes land use as the purpose for which the land is used and the types and sequences of activities carried out upon land.

TABLE 1: CHARACTERISTICS OF MAJOR GULLIES IN PROMINENT EROSION AREAS IN ANAMBRA, IMO AND ABIA STATES

LOCATION		Area of Basin km ²	Area of Gullies (active and inactive) Km ²	Area of active Gullies km ²	Length of Gullies (active & inactive) km	Width of Gullies (active & inactive) Km	Perimeter of Gullies (active & inactive) km	Maximum Depth m
STATE	AREA							
ANAMBRA	ALO	16.3	1.25	0.5	6.6	1.6	4	105
	NNOBI	32.0	2.5	1.5	3.6	1.5	30	75
	NNEWI	33.5	2.5	0.01	6.0	1.5	19.5	35
	ADAZI	21.0	1.3	0.3	3.7	1.3	10.5	30
	AGULU	5.0	0.4	0.11	1.8	0.5	4.5	90
	AGULU (Main)	12.0	1.25	1.5	3.2	2.0	7.5	150
	NANKA	11.2	2.85	1.4	4.0	1.3	6.0	90
	OKO	2.7	0.3	0.01	0.7	0.8	5.0	22
	EKWULOBIA	7.5	1.15	0.03	3.8	0.4	13.6	30
IMO	OKOHIA	41.9	28.61	0.03	12.5	5.6	45.0	55
	URUALA	21.6	1.30	0.07	1.5	1.0	22.5	30
	OLU	16.5	3.60	-	3.8	1.7	12.5	70
	AMUCHA	38.2	1.30	0.06	5.2	1.3	15.6	60
	OKWUDO	-	3.60	0.05	0.7	0.07	-	26
ABIA	ABIRIBA	13.4	1.20	0.07	4.6	2.4	26.2	120
	OHAFIA	8.0	0.05	0.15	1.0	0.4	18.4	-

Source: Ofomata G.E.K. (2001; p 261).

Table 2: The Proposed Land Quality Indicators for Southeastern Nigeria

Pressure	State	Response
<ul style="list-style-type: none"> Population size and density Size of built-up areas Fallow period Ratio of cultivated to cultivable area Land holding per farmer Land rent Crop combination Observed clearance of forest for cultivation Water use per day Price of fuel wood 	<ul style="list-style-type: none"> Soil fertility index Soil erosion rate Crop yield Household income Literacy/educational status of households Volume of solid waste per household Industrial pollution Loss of biodiversity Forest area Availability of fuel wood. Rural water quality. 	<ul style="list-style-type: none"> Cultivation of marginal land Abandonment of land Use of biological methods of soil improvement. Use of composite manure Use of chemical fertilizer Crop rotation Formation of farmers association Conflicts over land resources Changes in farming techniques. Change of crop Agroforestry practice Erosion control measures Action against industrial pollution

Following the above perspectives, a system of land use classification based on increasing degree of modification of ecosystems, from natural plant communities at one extreme to urban use at the other end is internationally accepted (Young, 1998). This is underscored by the fact that ecological balance, physical character and areal relationships of units of space change with use or development. This explains why United Nations Economic and Social Council (UNESCO) (2000) argues that changes in land use and land cover are likely to be the most important factor of global change in terrestrial ecosystems over the next few decades. According to the council, these changes represent profound and far-reaching environmental threats.

In southeastern Nigeria, the evidence of the modification of the ecosystems and increasing use of rural land for urban functions is conspicuous. Field investigation reveals that an increasing portion of rural lands in the region is being used for residential, commercial, industrial and infrastructural purpose. The spatial impact of the change is expressed in the vast expansion of built-up areas in the region. The invasion of the urban functions has resulted in decreasing land for agriculture. Consequently, land shortage has become an outstanding feature of southeastern Nigeria. While the average farm size for the country is 1.2 ha, a survey of some villages in the region yielded an average of only 0.45 ha (Okafor, 1991). Summarily, UNDP (1997) indicates that the land area per capita of 0.25 hectares for the region is the lowest in the country. The shortage results in land use intensification in order to increase productivity per unit area.

Agricultural land use intensification is the most significant aspect of land use change in southeastern Nigeria. The intensification is one of the responses to the unfavourable ecological conditions and man-land ratio, as farmers are compelled to engage in intensive cultivation of available farmlands (Okafor, 2001). Some aspects of the land use intensification are: inter-cropping (in which farmers embark on simultaneous operations as well as sequential use of farmlands throughout the crop growing seasons), changes in cultivation techniques such as digging trenches for root crops especially yam, cropping changes and fallow period reduction.

Fallow period reduction is however, considered to be the central expression of agricultural land use intensification in southeastern Nigeria. The survey by Okafor (1991) indicates that a variation in fallow period is compressed into a range with one-year minimum and a three-year maximum, with most farmlands clustering around 1-2 years. However, within this period, cassava is allowed to grow on the farms and this explains why southeastern Nigeria is regarded as a region of "permanent cultivation".

Another significant aspect of the land use change is the conversion of forestlands to non-forest uses. The forestlands are being converted to permanent agriculture,

In the riverine areas, sand mining is a common and an important economic activity. The activity increases the rate and extent of riverbank erosion and reduces down stream sediment deposition. It is estimated that close to 400 ha of land is lost annually to riverbank erosion in the delta region alone (Abam, 1993). World Bank (1995b) thus argues that since riverbank levees are the most populated areas and intensively cultivated, riverbank erosion results in the loss of some of the most valuable lands in the delta.

Diminishing forest resources, resulting mainly from deforestation is another serious environmental resource problem in the region. Okafor (1991) has shown that the deforestation of stream catchment areas has progressed for many years, resulting in a decline in river discharge during the dry months. Also, Nwagbo (2000) has shown that forest degradation is in turn causing soil degradation, water

human settlement and road construction at an alarming rate. It is estimated that economic activities are eliminating the rainforest in the region at 3.5% annually (World Bank, 1995b; UN, 2002). For the mangrove forest, World Bank (1996) estimates an annual deforestation rate of 700,000ha. Therefore, it is generally believed that the deforestation rate in southeastern Nigeria is much higher than the national average of 400,000ha/year (Atta and Adina, 1997) or the current national percentage change of 2.6 as estimated by World Bank (2002).

ENVIRONMENTAL CONSEQUENCES OF THE LAND-USE CHANGE

It has earlier been observed that the changing population - land relationship and the associated agricultural change have obvious implications not only for the socio-economic conditions of the people but also for the environment. The most important environmental imprint of the land use change, especially agricultural land use intensification is land degradation. By land degradation, it is meant the lowering in the capacity of land for agricultural production or its potential for environmental management - that is the lowering of land quality (Pieri et al 1995). The process of land degradation includes soil compaction, soil and water erosion, soil fertility decline, reduction of biomass, loss of soil biodiversity and other physical and chemical alterations. As a result of this process, average yield reduction are estimated at 8% for Africa with up to 50% loss of production in certain areas. (United Nations Economic and Social Council, 2000).

In southeastern Nigeria, the reduction of fallow period or absence of it has meant that soil fertility is not naturally restored. World Bank (1995b) reports that under continuous cropping in field trials in the region, yields declined by 65% for maize, 38% for yam and 25% for cassava. These results illustrate that shortened fallow periods lead to soil degradation and lower crop yields. Emphasizing the influence of fallow period reduction, Madu (2001) argues that coupled with scarcity of chemical fertilizers, most lands in the region have become impoverished and ineffective.

Soil erosion is however the hallmark of land degradation in the region. Ofomata (1981; 2001) has shown that over 70% of the region is affected by one form of soil erosion or another. The intensive cultivation of the soil together with the reduction in input of humus alters both the soil structure and the way they are organized with regard to one another. This results in the fine organic and inorganic particles being no longer bound together in crumbs, which makes the soil easily eroded away (Eze, 2001). Although different types of soil erosion manifest in the region, gully erosion is the most remarkable type. It is a serious environmental problem in the Igbo heartland, particularly, in Anambra, Imo and Abia States. Table 1 shows the characteristics of major gullies in the region. contamination, microclimatic change and the disappearance of wildlife.

In the Niger delta, the increasing use of land for mining activities has a number of negative consequences on the environment. As a result, the Niger delta suffers a number of degradation from many pollution sources. For instance, records show that Nigeria flares more gas than any other country in the world and this results in air pollution in the Niger delta (ESCRAVOS Gas Project, 1993). Furthermore, Niger Delta Environmental Survey (1997) indicates that environmental resource degradation is a priority environmental problem in the delta.

LAND QUALITY INDICATORS AS A TOOL FOR MANAGING THE LAND USE CHANGE

It is evident that land use change will continue to be part of human environment and development. The desirability of the change depends on whether the change enhances, optimizes or marginalizes its resource potentials. Therefore, it is proper that the change is not opposed but be adapted in order to reduce its vulnerability. Accordingly, Fischer (1999) notes that as human systems depend critically on the state of the environment, managing sustainable transitions of land use systems are of vital importance for the achievement of food security, maintenance of hydrological cycle, purification services to the ecosystem and mitigation of global warming.

The rural land use change in southeastern Nigeria can therefore be managed to bring about increased productivity and sustainable environment and development in the region. To benefit from the land use change, and ensure sustainable environment and development, it is here proposed that appropriate land quality indicators be developed and applied in the management of the land resources.

Land quality refers to the conditions of land relative to the requirement of land use including agricultural production, forestry, conservation and environmental management. Land quality indicators in this regard are measures or values derived from variables that provide estimates of the conditions of land relative to human needs and changes in these conditions and human actions, which are linked to the conditions (Pieri et al, 1995). Like other indicators, land quality indicators provide a means to monitor performance, and impact of human activities and policies on the environment (O'Connor, 1995). According to FAO (1999), indicators provide a readily understood tool for describing the state of resources and socio-economic activities and for assessing trends regarding sustainable development objectives. Thus, the major functions of indicators are:

- To assess conditions and changes
- To compare across place and situations
- To assess conditions and trends in relation to goals and target.
- To provide early warning information
- To anticipate future conditions and trends (Rigby, et al 2000)

A number of land quality indicators have been proposed for different ecological zones including sub-humid zone of sub-Saharan Africa (Pieri et al 1995). However, data on some of the indicators are not available or accessible to researchers and planners in developing countries. In most

cases, the equipment and technology for developing and applying such indicators are not within their reach. Moreover, the critical nature of land degradation in southeastern Nigeria requires that land quality indicators based on available data or those that can be measured and quantified with available technology be developed for the regions environmental resource management. This calls for a "home grown" indicators that will ensure sound environmental resource management of the region i.e. those based on local knowledge and "diagnosed health" of the environmental resources.

A relevant conceptual framework of land quality indicators for the region is the pressure – state – response framework (PSR). The framework attempts to represent the linkages between pressure exerted on land quality by human activities, resulting state of land quality including changes over time and the response of the society to the pressure and changes (Pieri et al, 1995; FAO, 1999; Rigby et al, 2000). The linkages are represented in figure 1

In the above framework, pressure refers to "human activities that exert a pressure on the environment and changes the quality and the quantity of natural resources. Society responds to the changes through environmental, economic and sectoral policies (the response). The latter forms a feed back loop to pressures" (Rigby et al 2000)

THE PROPOSED LAND QUALITY INDICATORS FOR SOUTHEASTERN NIGERIA

The following table presents the state-response-indicators proposed for the region. The indicators comprise demographic, economic, social and environmental issues that affect land quality and its sustainable management in the region.

Note: the indicators are not exhaustive. The number depends on the level or scale of application, data availability and the appropriateness of the chosen indicators for the kinds of decision, policy, management or action to be taken.

CRITICAL ACTIONS FOR APPLYING THE LAND QUALITY INDICATORS.

To apply the indicators in the management of land-use change and the environment of southeastern Nigeria, a number of critical actions has to be taken. First, it requires that a research has to be conducted in order to ascertain the state

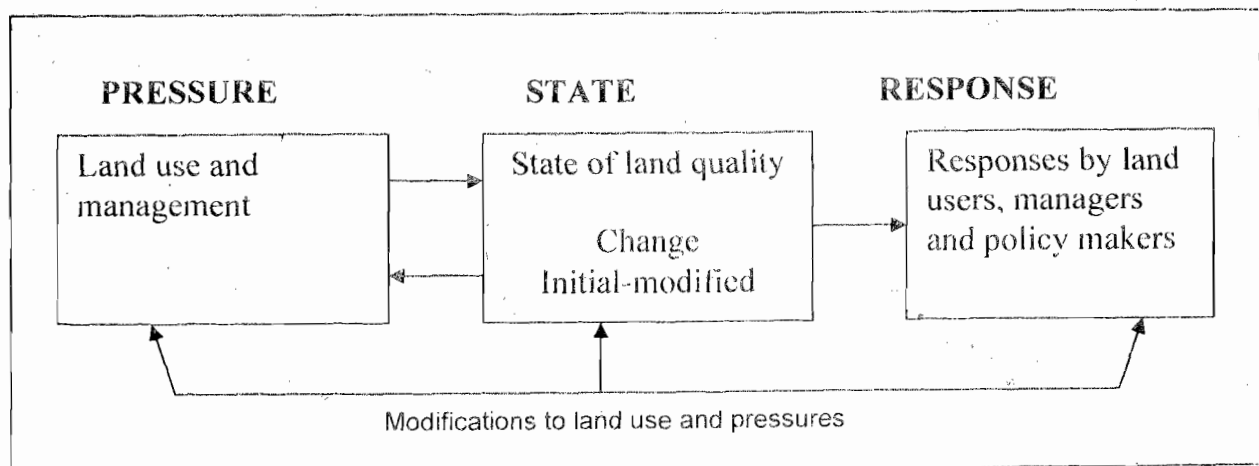


Fig 1: The pressure – state – response framework. Source: Pieri et al (1995).

and quality of environmental resources in the area. This is particularly necessary to gain an understanding of the resource management and environmental objectives among the various stakeholders including local communities. The results of the research will then be used to prioritize the problems for appropriate actions.

Second, an action plan has to be developed to correct past environmental degradation and to modify activities that are environmentally harmful.

Third, an effective institutional structure for the implementation of the action plan, initiation of future programmes and over seeing of environmental monitoring in the region should be established.

Fourth, public participation in the management of the land use system should be adopted. Participation is a shared understanding and empowerment leading to joint decision-making. This could be achieved through community groups and NGOs involvement, consultation with community based farmers and land management groups and local level conflict resolutions.

Fifth, Enlightenment and awareness campaign on the state of the environment and the linkages between population, environment and sustainable development should be embarked upon.

CONCLUSION

Rural land use change has been responsible for a number of negative environmental consequences in southeastern Nigeria. This shouldn't have been so if the environment and the land use change were properly managed. It is in this regard that the application of land quality indicators was proposed as a management tool.

The expected benefits from the application of land quality indicators will include: provision of base line data and information on land, land use and land use change; quantitative assessment of land degradation in the region; and the need for expanding the use of better land management for increased productivity and sustainable environment.

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