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SUSTAINABLE AGRICULTURE AND AGRICULTURAL LAND USE INTENSIFICATION IN EGBADO AREA OF OGUN STATE

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ABSTRACT

Post studies had indicated that population pressure, soil fertility, spatial location and land tenure are among the dominant factors that influence agricultural land use intensification in a number of regions. The present study, carried out in Egbado Division of Ogun State in Nigeria showed that these factors (or their proxies) are inversely related to Land Use Intensity (LUI). However, only population pressure and average yield of maize were found to be significant explanatory variables of LUI in the area of study. The paper concludes that policy makers should integrate the socio-cultural and economic goals of farmers into small scale farmers' planning for sustainability. This will alleviate the adverse impact of resource pressures (especially land) on sustainability and the development process.

INTRODUCTION

Developing technologies for sustainable food production is the current focus of research in Sub-Saharan Africa. This objective cannot be achieved without adequate understanding of those factors that influence the intensity of cultivation of available agricultural lands. Land mismanagement can result in rapid deterioration of soil fertility and consequently decline in productivity especially the marginal lands of the humid tropics.

The intensity of cultivation to which land is put is determined by a wide variety of factors, each interacting with one another. These factors include population, land attributes including spatial locations, land tenure and level of technology. Changing rights and access to land within the community also contribute to changing land use patterns.

An increase in population density leads to an increased demand for land, which induces a reduction in fallow period once the land frontier is reached (Boserup, 1965). Hence the critical issue for maintaining (or increasing) *per capita* food production is whether output per worker increases or decreases as intensification proceeds.

The objective of this paper is to examine those factors that influence the intensity of farmland cultivation as part of the overall goal of sustainable agricultural production in Egbado Area of Ogun State.

Review of Literature

The tendency towards intensive farming is accompanied by changes or modifications in inputs use patterns and general employment of farm resources. For example, land use intensification is characterised by institutional, cultural and social changes (Ruthernberg, 1980). Also Eboh (1990) had claimed that land use intensification in most farming systems tends to be accompanied by Farm size reduction, an adjustment made to accommodate the needs of increasing numbers of people. This leads to a more pronounced spatial differentiation of farm fields of between 0.20 - 1.5 hectares each (Nweke, 1981).

Many scholars believe that farm size is by and large a measure or reflection of pressure on land (Allen, 1965 and Datoo, 1976). As the pressure builds up, the size of farm fields become smaller and there is tendency to change from few near fields to many widely or scattered plots (Gleave and White, 1969). Following this argument Blaike (1971) and Datoo (1976) proposed the sizes of holding , the mean size of fields, distance to the nearest field and the mean distance to all fields as surrogate measures of population pressure on land. Consequently, cropping patterns vary by location of the fields, toposequence and distance of fields from the homestead. Also, the tendency will be to reduce farmland areas allocated to food crops that make the heaviest demands on soil fertility while multiple cropping becomes more pronounced (Ruthernberg, 1980 and Adesina, 1992).

METHODOLOGY

The study covers the old Egbado Division comprising of Egbado North and Egbado South LGAS of Ogun State, an area of about 539,224 hectares. The provisional census figures of 1991 put the population at 506,447 people with about 80% living in the rural areas. With the exception of the two Local Government headquarters, other settlements are villages or quasi-
urban centres. The people are homogenous, speaking the same dialect and are mostly farmers.

Data Collection:

Primary data using structured and pretested questionnaire were collected from eight rural communities using the stratified random sampling technique to ensure that villages in the two LGAs were presented. This was done after a preliminary survey of the communities in the area.

In each of the selected communities, the sample frame was compiled with the assistance of the ADP Extension Officer in-charge of each area, village heads and farmers groups where they exist. A total of 180 respondents were selected based on proportion of farmers in each community.

Data were collected on demographic variables of respondents, farm field attributes, cropping and fallow periods, farm productivity, land tenure systems, land fragmentation and cropping patterns. Visits were also made to some of the farms in an attempt to gain a better understanding of the cropping and farmland attributes. Secondary data were obtained from government publications.

Model Specification:

The land use intensification, making use of regression technique, was adopted in estimating the micro level determinants of land use intensity. It is given implicitly as follows:

$$LUI = f(L,H,M,T,Y,Ei)$$

where LUI = land use intensity index computed as:

$$\frac{Cr.100}{Cr + Fa}$$

Cr = Length of post fallow cropping (in years)

Fa = Length of pre-cropping fallow (in years)

L = Land hunger index measured by the number of competitors to family farmland

H = Home trekking time (in minutes)

M = Market trekking time (in minutes)

T = Ownership Status: 1 for owners, 0 for tenant

Yi = Average yield of some major crops obtained during the previous cropping season as a proportion of estimated average yield for the state.

Ei = Error term

Estimation Procedure:

In this work, a Pearson correlation run , the result of which is summarised in Table 1 was made. The degree of multi-collinearity among the explanatory variables are significantly low to justify their inclusion in the modified model. The major crops included in the model are maize(m) cassava(c) and vegetables(g). The insight provided by the result obtained necessitated the slight modification of the original model to that contained in expression 2 below:

$$LUI = f(L, H, T, M, Ym, Yc, Yg, Ei) \quad \text{.......... (2)}$$

where Ym, Yc, and Yg represent the yield information for maize, cassava and vegetables respectively. All other variables are as earlier defined.

The model in expression 2 was then examined structurally via a multiple stepwise regression analysis using Ordinary Least Squares (OLS) method . Structural equations of various forms including linear, semi-log and log-linear functions were obtained. Based on the criteria of the appropriateness of the signs of the explanatory variables, the significance of the regression coefficients and the value of the adjusted R^2 ($\bar{R}^2$), the linear form is selected and reported here.

FINDINGS AND DISCUSSIONS

Communal Farmland Cultivation-Fallow Rotations:

The practice of communal farmland cultivation fallow rotation exists within the study area. This practice occurred in 29.1% of the cases. Such communal intervention do not occur on individually owned lands. The number of delineated farmlands (or plots) in the communal cultivation - fallow cycle ranged from one to six plots per farmer. According to the farmers the number of plots in the cycle has been decreasing over the years as a result of increased demand for farmland by others, old age of the cultivators, shortage of family labour and increased tendency towards individualisation of farmlands.

Fallow periods for most fields ranged from one to five years with a mean of three years. This is significantly different from an average of six years which existed about 20 years ago (See Table 2). The acquisition of land for a dam construction and farm settlement by government accentuated this trend in some of the communities covered by the study. On the other hand, cropping periods ranged from one season (about 5-6 months) to two years before fallow is enforced by the community.

Spatial Differentiation of Farm fields:

Farmers across the study area distinguished between compound, near and distant fields. Increased difficulty in obtaining new lands for farming, incessant disputes on ownership of distant fields and better accessibility encouraged the importance of compound and near fields cultivation. One striking features of the compound fields is the occurrence of many crops under the forest groove canopy. Vegetables and fruits are the common crops plus some stands of maize and cassava. With few exceptions, different types of soil amendments such as household refuse, animal dung, plant debris and kitchen ashes were applied to the compound fields.

In most villages, the soils of near fields were ranked higher in fertility than distant fields. On the average, near fields are fallow for 2 years and distant field for 3 years. Being agrarian communities, the initial conditions for the settlement in the villages seemed to be fertility of surrounding farmlands, a necessary condition for survival. This may explain the higher fertility claimed for the near farm than distant farms.

Regression Analysis:

The results of the stepwise regression analysis are presented in Table 3 and Equation 1. The t-values of the respective regression coefficients are expressed in parenthesis.

With respect to equation 1 which is the lead equation, land hunger index (L), home-trekking time (H), land ownership status

(T), market-trekking time (M), average yield of maize (Ym) and average yield of cassava (Yc) all combine to explain about 42% of the adjusted variability in land use intensity.

Land Hunger Index:

Land hunger index, as measured by the number of competitors to family farmland was found to be a negative but significant explanatory variable in land use intensification. This is not in line with *a priori* expectation. The final equation indicates that by increasing the number of competitors to specific farmland by one, land use intensity decreases by 261%. Possible explanations are that some of the identified competitors to family lands are absentee owners presently not engaged in farming, or the family farmland frontiers are yet to be reached within the area of study.

Trekking Distance:

The home-trek duration is also a negative explanatory variable in line with *a priori* expectation, though it is not a significant relationship. An increase of one minute in home trek duration reduces land use intensity by 5%. A similar explanation holds for market-trek duration.

Land Ownership:

With respect to ownership status, the model adopted examines the changes in land use intensity associated with owner operations (i.e. primary access to farmland) as opposed to tenant operators (i.e. secondary access). Evidences from the study area indicated a negative but non-significant relationship between LUI and ownership status. The negative relationship implies that owner operators (mostly indigenes) cultivate less intensively per unit area of farmland while tenant operators (non-indegenes) usually cultivate the limited farmland granted to them, under various tenancy conditions, more intensively. The non-significant nature of this variable however shows that land tenure status is not an important component of land use intensification model in Egbado Area of Ogun State.

Crop Yields

The yields (expressed as percentages of state average) of the major crops grown in the area viz:- maize, cassava and vegetables shows negative relationships with LUI. Only maize however exhibited a significant relationship. As expected, virgin farmlands or less cultivated farmlands tend to be more fertile and hence more productive especially under smallholder farming practices where the use of fertilizers and other improved cultural practices are not common. As these farmlands are continuously cultivated and in the absence of external nutrient application to the cropped land, their productivities reduce gradually. Such a decline in productivity is reflected by changes in the physical and biochemical characteristics of the soil. Consequently, in a portfolio system of farmland holdings under various tenure arrangements and where the use of external inputs that can help to increase or at least maintain yield levels (e.g chemical fertilizers) are not common, farmers perception of farmlands' fertilities may influence land use intensification. Only four (2.2%) of the farmers interviewed claimed to have applied fertilizer to their farms within the last 3 years.

CONCLUSIONS AND POLICY RECOMMENDATIONS

The study shows that land use intensification in Egbado Area of Ogun State is a complex phenomenon which could not be adequately explained by one variable. Under the prevailing circumstances, where the use of chemical fertilizers to farmlands is not common, farmers' perception of fertility status of the various farm plots may be an important component of the Land use intensification model. The desire to minimize the time-distance trek might have also encouraged them to cultivate near fields more intensively than for fields.

Consequently, policy makers concerned with alleviating the adverse impact of resource pressures (especially land) on sustainability and the development process should consider other factors which can also influence the agricultural production decision process. The socio-cultural and economic goals of farmers would have to be adequately integrated into small-scale farmers' planning if desired impact is to be made.

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Table 1: Correlation Matrix

	LUI	L	H	T	M	Tm	Yc	Yg
LUI	1.000							
L	−0.247	1.000						
H	−0.042	0.245	1.000					
T	−0.054	0.094	0.039	1.000				
M	−0.051	0.077	0.530	−0.065	1.000			
Ym	−0.009	−0.005	−0.144	0.020	−0.132	1.000		
Yc	−0.061	−0.044	0.045	−0.029	0.032	0.184	1.000	
YG	−0.079	0.271	0.142	−0.100	−0.063	0.003	−0.066	1.000

Table 2: Statistics on Farmland Cultivation - Fallow Periods

Cultivation - Fallow Period Parameters	Minimum	Maximum	Mean
Number of plots of farmlands owned	1	6	3
Total hectarage cultivated (ha)	1	60	10.3
Current fallow period for most fields (yrs)	3	5	3
Fallow period about 20 years ago (yrs)	5	10	6

Source: Field survey, 1996

Table 3: Results of stepwise Regression Analysis - Linear function

Step	Independent Variable	Regression Coefficient	R^2	$\bar{R}^2$	Incremental R^2	F- ratio	% Contri-bution
1	L	-2.41* (-2.33)	0.057	0.047	0.057	5.420	4.7
2	H	-0.02 (0.27)	0.188	0.099	0.131	2.717	5.2
3	T	-5.36 (-0.30)	0.353	0.270	0.165	2.920	17.1
4	M	-0.07 (-0.50)	0.465	0.333	0.112	1.466	6.3
5	Ym	-0.43* (2.09)	0.585	0.389	0.120	1.161	5.6
6	Yc	-4.79 (1.69)	0.671	0.421	0.086	3.040	3.2

Equation 1:

Leading Equation:

Constant	133.39
L	-2.61*
	(-2.32)
H	-0.05
	(0.46)
T	-6.65
	(-0.36)
M	-0.07
	(-0.490)
Ym	-0.21*
	(-2.01)
Yc	-4.79
	(-1.69)
R^2	0.671
$\bar{R}^2$	0.421
F	3.040*

* Significant at 5% level.