DRAFT

Social Welfare Sustainability in Rural Nigeria: Path to a Greener Environment

S.O.M. Awoniyi[a], T.T. Amos[b], A.O Adeola[c] and M.M. Omole[c]

a. Department of Agricultural Economics and Extension,
Joseph Ayo Babalola University, Nigeria

b. Department of Agricultural Economics,
Federal University of Technology, Akure, Nigeria

c. Crop production and Soil Department,
Joseph Ayo Babalola University, Nigeria

The **United Nations Research Institute for Social Development** (**UNRISD**) was established in 1963 as an autonomous space within the UN system for the conduct of policy-relevant, cutting-edge research on social development that is pertinent to the work of the United Nations Secretariat; regional commissions and specialized agencies; and national institutions.

Our mission is to generate knowledge and articulate policy alternatives on contemporary development issues, thereby contributing to the broader goals of the UN system of reducing poverty and inequality, advancing well-being and rights, and creating more democratic and just societies.

UNRISD, Palais des Nations
1211 Geneva 10, Switzerland

Tel: (41 22) 9173020
Fax: (41 22) 9170650
Email: info@unrisd.org
Web: www.unrisd.org

Abstract

The on-going debates on green economy have stimulated serious interest in resources management in a sustainable manner the world over. Deforestation is on the increase in the rural areas in Nigeria because people are poor. Again, scarce budget resources poses a big challenge for the government to ensure consistency of policies and strategies that promote long-term economic growth, raise smallholder productivity, achieve food security, and reduce rural poverty and deforestation sustainably. Also, given the low productivity of the soil in the tropics to which Nigeria belongs, the poor state of the farmers and subsistence nature of agriculture in Nigeria, green environment may be difficult to sustain.

It is argued in this paper that improved rural social welfare situation can reduce poverty and ecosystem degradation. This was verified in this paper by quantifying challenges and poverty level in some rural communities in Nigeria and also established the link between poverty and deforestation in these communities. The study found that areas with low poverty profile exhibited lower rate of deforestation. The study recommended accelerated improvement on social welfare services in the areas and also suggested policy reform that integrates the principles of environmental accounting and carbon marketing for reduced deforestation in these areas.

Introduction

Nigeria faces serious deforestation and degradation problems because of the pressure on the environment (FAO 1995). The challenge to produce food in adequate quantity is ever urgent in Nigeria due to the population growth rate of 2.6 per cent per annum of about 150 million people. For instance, the demand for rice in Nigeria has been growing at about 10 per cent per annum since the mid 1970s creating a rice self-reliance ratio below 80 per cent in 2000. Nigeria's spending on rice importation rose to US $756 million in 2002 without accounting for unrecorded smuggled rice into the country (Bamidele, Abayomi and Esther 2010; CBN 2006; Ogundele and Okoruwa 2006; Akande 2003). This has resulted in land expansion for food production (Oyekale 2007) causing high degree degradation of about 54.2 per cent, covering 495,662 km^2 of the total land area (FAO 2005). The agricultural sector consumes a third of total water withdrawals and well over half of the cultivable land to produce food for 150 million people in Nigeria (Oyekale 2007). According to Ola-Adams and Onyeachusim (1993), 69 mammalian species, 5 species of reptiles and 19 species of birds are on the endangered species list of Nigeria. Why is Green environment going to be difficult to sustain in Nigeria? How can our agriculture conform to Green environment? How can improved social welfare going to be of help? This paper intends to examine these questions.

Challenges in sustaining green environment in Nigeria

The on-going debates on green economy have stimulated serious interest in resources management in a sustainable manner the world over. However, deforestation is on the increase in rural areas in Nigeria. The ecological footprint deficit of -0.32 was recorded for Nigeria by the Global Footprint Network in 2010. Rural Nigeria sheltered about 79 million people with 36.4 per cent of them being poor leading to serious environmental problems due to over exploitation of the forest lands which the people see as the last resort. This has, however, served as impetus in accelerating the speed of achieving the Millennium Development Goals (MDGs) by the government but which has raised the profile of social sector investments in Nigeria. Therefore, scarce budget resources poses a big challenge for the government to ensure consistency of policies and strategies that promote long-term economic growth, raise smallholder productivity, achieve food security, and reduce rural poverty and deforestation sustainably. Given the low technological development, low productivity of the soil in the tropics to which Nigeria belongs, the poor state of the farmers, poor farming practices, subsistence nature of agriculture and low literacy level in rural Nigeria, green environment may be difficult to sustain. This is analysed as follows.

Low carbon investment

Global green investment drive would pay off in terms of jobs, cleaner air and energy use' say the UN. The UN also acknowledges this would come at a cost of 2 per cent GDP of every nation's economy. This is already a huge investment for a nation that is still grappling with feeding her citizens, reducing poverty and improving living standards. Besides, Nigeria with US$ 5,398 billion external debt (DMO 2011), like many other nations in Africa, is burdened with heavy debt overhang which must be cleared. Africa's external debt was around US$300 billion in 2009 and about 16 per cent of the continent's export earnings were spent on external debt servicing. Even some of the countries that benefited from the Highly Indebted Poor Country (HIPC) Initiative

and Multilateral Debt Relief Initiative (MDRI) in 2005 are still in debt distress or at high risk of becoming so, according to the IMF and World Bank's debt sustainability analysis (NEPAD, 2010). The Global financial crisis again weakened domestic growth performance in Africa as a result of reduction in Foreign Direct Investments (FDI) and portfolio investments. Furthermore, commodity exporters suffered from depressed prices (IMF World Economic Outlook, 2009). Meeting up then, is a great challenge.

Nigeria and many African nations are yet to grow the technology that can handle green economy and as such will depend on the industrialised nations for its supply. Intelligent low- or zero-energy buildings, green energy, etc. are technologies developed by the industrialised nations. Some developing economies lack the technical capacity to handle it (Robinson, 2009). In addition, infrastructure to support is lacking indicating another level of investment. Moreover, since it is a new technology, new skills will have to be acquired hence training need which is another level of investment. Due to the low level of technological development, Nigeria and the developing economies in SSA may become more dependent on the North and the developed economies. This may explain why Europe is set on investing €270 billion annually over the next 40 years on green economy.

Reducing emissions from *deforestation* and *forest degradation* (REDD) mechanism and probably, carbon finance may produce carbon credits as an offset for emissions. The question is if the credit so raised can actually offset the investment needs for green economy in the developing economies. Green economy is undoubtedly going to benefit the entire world as it appears, however, the benefits look to be lopsided. Some are about to gain than the others. The developed economies are poised to create wealth from the problem - *climate change* - they created. They are rushing and investing heavily to catch-in on the market before it becomes saturated which necessitated the creation of new patent classification scheme for the emergence of green trade for green energy generation (UNEP 2010).

Agricultural policy environment

New Agricultural Policy (NAP) in 2001 was part of the strategy to reform and accelerate development in the agricultural sector. Agriculture's contribution to poverty was also recognised in the document. However, no guidance was given on the sequencing and devolution of responsibilities between state and local governments in NAP. The private sector was also recognized as a prime mover of the economy, and macroeconomic policy environments needed to accelerate private sector development are being pursued. But the successes of these policies have been limited and need to be evaluated. The NAP and NEEDS strategies also lack implicit and explicit monitoring and evaluation impact mechanisms that would ensure that lessons learned from successes and failures of past development strategies are incorporated into future strategies. Grassroots participation in agricultural policy formulation process is still lacking. Projects and programmes are put forward from the head which is one of the reasons for policy failure in Nigeria.

Agricultural funding

Public spending on agriculture in Nigeria is very low compared to those of other developing nations. The Comprehensive Africa Agriculture Development Program (CAADP) includes a target of 6 per cent annual agricultural growth, supported by the allocation of at least 10 per cent of the national budget for agriculture. However, less

than 2 per cent of total federal expenditure was allotted to agriculture during 2001 to 2005, far lower than spending in other key sectors such as education, health, and water. This spending contrasts dramatically with the sector's importance in the Nigerian economy, which ranged from 20 to 30 per cent of total GPD since 2000; and falls well below the 10 per cent goal set by African leaders in the 2003 Maputo agreement.

Table 1: Government expenditure in agriculture as a share of total expenditure (per cent)

Country	2002	2003	2004	2005	2006	2007	2008
Uganda	4.2	4.2	7	9.7	5.2	3.5	5.4
Benin	3.5	4.4	3.9	6.4	7.5	6.1	5.6
Ghana	3.9	5	6.7	5.8	1	9.6	10.3
Mali	11.4	12.7	14.5	10.8	10.6	11	-
Nigeria	3.2	3.2	3.6	4.4	5.8	7	-
Kenya	5	4.6	5.1	6.6	5.9	4.4*	4.8

Source: Shengen Fan (2009)

Agricultural research and development (R&D)

Nigeria was one of the more advanced African countries in terms of the quantity and quality of its academic research institutions. Currently, Nigeria has about sixty-six governmental research institutions under the ambit of six key government ministries. However the capacity and resources of these organisations are limited and direct linkages between their research and public policy formulation remain minimal. The destabilisation and collapse of many educational and research institutions during military rule in the 80s-90s led to the dilapidation/collapse and the marginalisation of these institutions from the policy process. Their role and relevance decreased along with their funding, as military governments tended to take policy decisions based on regime protection, as opposed to civic benefit (DFID 2007).

Soil productivity

Farming in Nigeria is highly subsistence with low output because of low productivity of the soil. Only 50.4 km^2 is classified as having high productivity (FAO 1970). This has lead to Nigeria having agriculture with a high quantity of inorganic fertilizer and chemical use which are highly injurious to life and environment. About 511,841 mt of fertilizer was imported in 2003 as against 239,916 mt in 1998 (Dangote 2004). The quantity increases as propaganda on inorganic fertilizer and chemical use for increased output in the country intensifies (Bationo 2006; Dangote 2004). A great deal still need to be done in the country to put agriculture in Nigeria on low carbon growth path as there are over 30 fertilizer blending plants with serious pressure to increase fertilizer production in Nigeria.

Social dimension

Again, poverty of over 70 per cent of Nigerian population, majority of who dwell in the rural areas, is a serious problem. Youth unemployment aggravates poverty level in the country as one out of five Nigerians is unemployed. It is estimated that each year as few as one in ten of the six million new entrants to the labour market find jobs (Kwakwa et al. 2007). The World Bank's growth and employment study heralds this as "a growing employment crisis". The foregoing had resulted in indescribable pressure on the

environment in Nigeria, especially in the rural areas, as great majority turns to the land as the source of livelihood. Moreover, the challenges of high population pressure and the rapid pace of human and sundry economic activities viz urbanisation and industrialisation have also led to reduced availability of arable land per capita and, by implication, agricultural intensification and also, some farmers have been forced to farm on marginal lands. For instance, the per capita land area (ha) in 1960, 1990, and 2025, respectively, was 0.68, 0.34, and 0.14 and Per capita renewable fresh water availability (m3 per person y−1) in 1950, 1995, 2025, and 2050, respectively, was 8,502, 2,506, 1,175, and 827 for Nigeria while the minimum per capita renewable fresh water required is 1,000 m3 y−1 (Junge et al. 2008). Given existing levels of agricultural technology, the capacity of available land has been exceeded by the over 50 million people who mine soil nutrients to support their livelihoods in Nigeria, which is the case in many African countries.

Gender bias

However, it is ironical that women and their contributions to agriculture and rural development are seldom noticed. Furthermore, they have either no or minimal part in the decision-making process regarding agricultural development. Gender inequality is therefore dominant in the sector and this constitutes a bottleneck to development, calling for a review of government policies on agriculture to all the elements that place rural women farmers at a disadvantage (Ogunlela and Mukhtar 2009).

Low farmers literacy level

Low literacy level of farmers is not helping situation in rural Nigeria. Poor access to education and lack of education facilities are responsible as well as very low living standard which makes families keep their children out of school. At times, rural farmers view education as non-essential and the use of child labour for agricultural production also reduce children participation in formal education. These made Nigeria one of the largest out-of-school populations in the world having national education ratio of 59 per cent for girls and 68 per cent for boys. A GPI of 0.86 existed in the National education figures of 2006 and the country still ranks a very low 159 on the 2006 United Nations Human Development Index (UNESCO, 2009; DFID 2007). Lack of education predisposes them to practices and misuse of farm inputs which impact on the environment negatively. All of the above have culminated into serious stress being placed on the biophysical environment in rural Nigeria making healthy land, clean water for life to be elusive in many of these areas. Nigeria is suitable for this study being second to South Africa in GDP growth, likewise is the population of the country which is the largest in Africa as is the level of deforestation.

Working out the path to green environment

Nigeria's green environment project is possible by redefining agriculture. Rural people of Nigeria depend on the environment for their livelihoods. The sustainability of their livelihoods depends on measures to replenish natural resources so that they can continue to provide the people with their source of livelihood. Achieving this requires political commitment by the leadership, who must recognise that failure to protect the environment means failure to meet the aspirations of the people. The political, social, and economic consequences of failure will be too costly for the nation. The following strategies will be of help in the transition to green economy.

The neglect of evidence-based policy formulation and aversion to reforms should be avoided and sincerity of purpose in policy formulation and execution must be embraced. A successful strategy in agricultural policy should include evidence based priority-setting, and sequencing of policy actions by relevant development actors such as state, private sector, and civil society organizations, with clear indicators and a mechanism to monitor and evaluate progress and impact. Furthermore, policy in Nigeria should reflect pro-poor growth since majority of Nigerians who are poor reside in that part of the country.

Agriculture is the single largest contributor to the well being of the rural poor, sustaining about 86 per cent of rural households in Nigeria. According to the central bank of Nigeria (2006), the sector accounted for 41.8 per cent of the overall economy in 2006 followed by the non-oil industry (26.1 per cent), while crude oil only accounted for 21.9 per cent. Spending to agriculture is one of the most important government instruments for promoting economic growth and alleviating poverty in rural areas (Fan and Saurkar, 2006). As such, agriculture must be heavily invested on through the upgrade of rural infrastructure to boost productivity, and increase competitiveness if the government's poverty reduction goals are to be achieved; Poverty in Nigeria cannot be alleviated in isolation since the majority of the people affected are farmers in rural Nigeria. Very high public investment for long-term development in agriculture is now necessary more than ever before. This would be needful to raise income, create new jobs and reduce poverty more so that the world is transforming to clean energy status. The implication of this on Nigeria's economy is bad as price of oil, from which over 80 per cent of the national income is derived and upon which budget document is prepared, will soon crash. An investment as high as 40-50 per cent of the GDP is recommended by the authors to raise national income through export and enhance welfare in the country.

Increase attractiveness of farming to youth

Unemployment will reduce when infrastructures are provided in the hinterland as this reduces pressure on urban facilities, rural urban migration reduces, infrastructure provision e.g. feeder roads network, clinics, communication improvement. Irrigation facilities are still very poor despite the existence of River Basin and Rural Development Authorities (RBRDA). Land and property right protection should be considered for increased access to land. The land tenure systems in the southern part of Nigeria, limit land availability to would be farmers, women and the landless. Promotion of social inclusiveness in development programmes can also raise women's income.

Farming practices for green environment

National agriculture focus needs to change from eco-efficiency to sustainable consumption and production. Moving from unsustainable, increasingly unaffordable and petroleum-based and toxic fertilizers and pesticides, to organic regenerative farming *systems* that sustain and improve the health of our world population, our soil and our environment should be the focus presently. UNEP reported that organic practices in Africa outperformed industrial, chemical-intensive conventional farming, and also provided environmental benefits such as improved soil fertility, better retention of water and resistance to drought. Food production should be based on "natural processes" like crop rotation and organic fertilizers (LaSalle et al. 2008). Organic farming has also been found to save money and energy, mitigate global warming, enhance biodiversity, improve resiliency to weather variation, increase food nutrient density, and reduce toxic

load (Azeez 2008; Pimentel et al. 2005; Douds et al. 2007; Galvez et al. 2001; Buyer and Kaufmann 1997; Doran et al. 1987). Junge et al. (2008) recommended cover cropping, improved fallows, inter cropping and minimum tillage as practices that reduces soil degradation.

Social welfare in green environment

Agriculture distorts environmental equilibrium through deforestation which finally leads to environmental degradation. Rural environmental devastation resulting from agricultural activities is as a result of pressure on the environment due to poverty of the rural dwellers (Omonona 2008). However, social welfare has been found to impact on poverty (Fording and Berry 2000), though the assertion has been contested and that social welfare actually creates a negative incentive. Evidences abound that in welfare states, poverty decreases after countries adapt welfare programs (Bradley et al. 2003; Fording and Berry 2000; Kenworthy 1999) which is the reason this study looks at the effect of social welfare on poverty and hence, its indirect effect on the environment so as to make it a factor for consideration in planning environmental sustainability effectively in Nigeria.

Methodology

Sources of data

The study used data that was obtained by the Ondo State Ministry of Agriculture and Rural Development in 2010 on Community-Based Forest Management Initiative. Three forest reserves were covered to quantify encroachment level. The data were mainly from primary sources through field survey. These are Idanre FR (latitude-06.91900 & longitude- 005.19680); Oluwa FR (latitude-06.85394 & longitude- 004.56545); and Oyinmo FR (latitude-07.36628 & longitude- 005.64787). From the three FRs 200 respondents were selected randomly from each FR. Further, only 452 questionnaires of the total 600 for the entire FRs were processed for the study. This gave a response rate of 75.3 per cent. The data were collected by trained enumerators between the months of June and September 2010. Data on socioeconomic variables of the farmers and species diversity in the forest were collected (CBFMS Report 2010).

The total land area of Ondo State is 14,799 sq km. The vegetation types include mangrove/coastal swamps and fresh water swamps in the extreme south along the Atlantic coast of the state. This is followed inland by the luxuriant lowland rainforest i.e. humid tropical high forest, and the derived savannah respectively. It is estimated that 17.27 per cent of the total land area in Ondo State is covered by the humid tropical rain forest which is found in 9 (nine) out of the 18 local government areas. It is found in the south and central parts of the state. The mangrove/coastal and fresh water forests are found mainly along the Atlantic coast line and flood plains of Oluwa, Ofare, and Talita Rivers. The dry secondary forest and derived savannah occur in the north (CBFMS Report 2010).

Of the total area under forest, 2,115 sq km (14.5 per cent) is under mangrove/coastal swamp and fresh water swamps. The total area for high forest is estimated as 10,993.54 km2 while the derived savannah consists of 1690.43 sq km (11.4 per cent). Major species found in the Ondo state high forest include a total of 52 local hard wood species distributed in 27 families.

Table 2: Summary of the forest types and other land uses in Ondo state

Types of forest	Area (km2)	%
Mangrove /coastal swamp forest	705.00	4.75
Fresh water swamp forest	1,410.00	9.53
Lowland rain forest	2,555.43	17.27
Derived savannah	194.76	1.32
Teak plantations	88.35*+	0.59
Gmelina plantations	190.09*	1.28
Other forests (indigenous/pine plantation)	3.68 *	0.02
Other land uses (in the forest area, Inclusive of high forest and savannah)	9,651.69	65.22
Total	**14,799.00**	**100**

Source: CBFMS report (2010)

The instrument used for data collection includes the following items: Consumption expenditure - that is the amount spent on food, clothing and foot wear, housing, energy, education, health care, transport and communication by the household; Income - wages and salaries, tips and bonuses, net profit from farm and non-farm enterprises, property income such as land rent, interest and dividend, transfer payments received and other money receipts such as insurance proceeds, lottery etc. Demographic characteristics of household members; Household economy and coping strategies.

Analytical techniques

Poverty analysis

This study employed a number of analytical techniques. These techniques include descriptive and inferential statistics, Foster, Greer and Thorbecke (FGT 1984) weighted poverty measure and the multivariate regression models. The descriptive statistics be used include tables, percentages and all forms of indices to characterise the dimensions of social capital and types of local level associations. The popularly used FGT weighted poverty index for quantitative poverty assessment was used for this study due to, among other things, its additive decomposability into sub-groups. The FGT measure for the ith subgroup ($P_{\alpha i}$,) is given below.

The main analytical technique used for this study is the Foster, Greer and Thorbecke (FGT) weighted poverty index (17) as shown below:

$$P_{\alpha i}^i = \frac{1}{n}\sum_{i=1}^{q}\left[(z-y)\Big/Z\right]^{\alpha}$$

$$when \quad \alpha = 0, \quad P_0 = \frac{1}{n}\sum_{i=1}^{q}\left[(z-y)\Big/Z\right]^{0} = \frac{q}{n} \quad \rightarrow Poverty\ incidence\ or\ head\ count$$

$$\alpha = 1, \quad P_1 = \frac{1}{n}\sum_{i=1}^{q}\left[(z-y)\Big/Z\right]^{1} \quad \rightarrow Poverty\ gap\ or\ depth$$

$$\alpha = 2, \quad P_2 = \frac{1}{n}\sum_{i=1}^{q}\left[(z-y)\Big/Z\right]^{2} \quad \rightarrow Poverty\ severity$$

where

n	=	number of households in a group
q	=	the number of poor households
z	=	poverty line
y	=	the per capita expenditure (PCE) of the ith household; and,
α	=	degree of poverty aversion

The FGT measure for the whole group or population was obtained using

$$P_\alpha = \sum_{i=1}^{m} P_{\alpha i} n_i / n$$

Where P_α is the weighted poverty index for the whole group, m is the number of sub groups while n and n_i are the total number of households in the whole group and the ith subgroup respectively. The contribution (K.;) of each sub-group's weighted poverty measure to the whole group's weighted poverty measure will be obtained by using

$$K. = n, Pa, /nPa$$

The poverty line was obtained using the two-thirds of the mean per capita household expenditure.

Determinants of welfare

This study benefited from the analytical framework earlier applied by Narayan and Prichett (1997), Grootaert (1999) and Omonona (2009). Essentially, the customary or conventional model of household economic behaviour under constrained utility maximization was used to relate the level of household expenditure (as money – metric indicator of welfare) directly to the exogenous asset endowments of the household and variables describing the social and economic environment in which the household makes decision. The model is as follows:

$$y_i/z_i = \beta_0 + \sum \beta_{1i} X_i + \sum \beta_{2i} C_i + \varepsilon_i$$

Where: y_i/z_i = welfare ratio; y_i = expenditure per capita of household I; z_i = poverty line; = Model parameters; X_i = a vector of household characteristics and ε = error term. Ordinary least squares (OLS) regression and fixed effects regression were the two variants used in this study. This makes it feasible to estimate a fixed effects model to control for unobservable common to the local community.

Variables definition

Welfare ratio defined as the per capita expenditure divided by the poverty line; age-age in years of the household; gender - male headship of a household (D = 1 if male, 0 if otherwise); household size-number feeding together in a house; education level-the average years of formal education of the household head; marital status of household head (D = 1 if married, 0 if otherwise); farming: household head is into farming as primary occupation (D=l if farming, 0 if otherwise); safe water - household members have access to safe water (piped water, borehole and protected well (D=l if yes, 0 if otherwise)); safe toilet - household members have access to safe toilet (water closet, flush to sewer and VIP latrine (D=l if yes, 0 if otherwise))

Poverty line derivation

The per capita expenditure (PCE) was used to determine this threshold or the value of expenditure required on food and non-food items for a healthy living by a person. The table below shows the distribution of PCE by deciles.

Table 3: Per capita expenditure distribution

Decile	Mean PCE	Expenditure distribution (%)
1	233.34	1.45
2	555.12	3.46
3	834.59	5.18
4	939.00	5.83
5	1435.37	8.92
6	1915.60	11.90
7	2002.68	12.43
8	2559.47	15.89
9	2726.54	16.93
10	2899.22	18.01
Total	16100.93	100
Mean	1610.09	
$^2/_3$ MPCE	1073.39	

Source: Computed from CBFMS Field Survey Data (July - September, 2003).

From table 3 above, the mean PCE increased from the first decile to the tenth decile giving a total of 16,100.93, a mean PCE of 1,161.09 and a poverty line of 1,073.39.

Results and discussion

Poverty profile of sampled households

The decomposition of poverty based on several characteristics was done in order to be able to relate poverty to changes in those characteristics. Two poverty profiles of interest in this study include that of gender and forest reserves locations. The latter was done to be able to compare the profiles with the biodiversity indices table reported in the Community Based Forest Management Strategy (CBFMS Report 2010).

The relationship between the genders of the household heads in the study area is shown in table 4 below. The dichotomy in the profiles revealed that male headed households appear better in terms of the incidence, depth and severity of poverty. This is contrary to Omonona's (2009) findings. The gap could have arisen from women's general lack of access to production inputs and voice in decision making (Ogunlela and Mukhtar, 2009). Again, Poverty was generally higher when the data was pooled.

Table 4: Poverty by gender

Gender	P_0	P_1	P_2
Male	0.252	0.206	0.162
Female	0.316	0.218	0.143
All	0.370	0.253	0.121

Source: Computed from survey data analysis

Table 5 shows the profile on locations i.e. on forest reserves basis. This became necessary based on the report submitted by the committee that examined encroachment levels in the forest reserves. The report claimed that encroachment was high in the forest reserves and issues like unemployment, poverty, and population increase among other reasons were given by the respondents in the reserves enclaves for encroachment (CBFMS report, 2010). This study, therefore, looked at poverty by FRs for comparison with encroachment levels in FRs reported by the CBFMS for policy action. Respondents at the Oyinmo FR enclaves appear to be the poorest of the three FRs in terms of incidence, depth and severity which stands at 39 per cent, 36 per cent and 5 per cent respectively. Idanre FR respondents were poorer and Oluwa FR enclaves appear to be fair but highest in severity.

Table 5: Poverty by forest reserves

Forest reserve	P_0	P_1	P_2
Idanre	0.381	0.251	0.079
Oluwa	0.367	0.213	0.055
Oyinmo	0.391	0.364	0.054
All	0.372	0.198	0.043

Source: Computed from survey data analysis

Determinants of household welfare

It is not enough to establish that poverty really existed but also needful to know the determinants of welfare in the area for policy intervention aimed at restoring the forest and at the same time, enhancing welfare of the people. Following Omonona (2009), OLS model was used to estimate the determinants of welfare among the respondents. Fixed effects regression was also used in estimating the determinants of rural poverty among the respondents first. The rural households were divided on gender and FR basis. This enables the estimation of determinants of poverty for both sexes and for each FR to be able to capture factors that were responsible for their poverty. Fixed-effect models also make the control of unobservable factors common among the different enclaves possible (see Behrman and Deolalikar, 1993 and Omonona, 2009).

Gender dimensions of determinants of welfare

The study probes further to know the determinants of welfare levels on gender basis. This is necessary for policy direction for intervention at improving welfare in the area. This was done on sex of the household head basis. Table 6 below shows that age, household size and marital status are the significant variables. A unit increase in the age of household head increased welfare by 1.5 per cent; 1.8 per cent reduction in welfare

exited per unit increase in household size. This is understandable because as age increases, especially in farming which is energy sapping, capability is enhanced but this reduces as old age is reached. Agriculture is subsistence in Nigeria and so, age is a factor. Likewise, a large household size connotes large expenditure on consumption. Residence in Oluwa FR also contributed to welfare likewise safe to toilet and farming.

Table 6: Determinants of rural poverty among male headed household

Variable	OLS		Fixed effects	
	coefficient	t-value	coefficient	t-value
Constant	1.2431***	5.476	-	-
Age	0.4986	1.362	.0152**	1.460
Household size	-.0953*	-.1.3123	-.0184**	-3.0223
Marital status	.0229	.1.3264	.0353*	1.7468
Primary edu.	-.0141*	-.1116	-.2168	.3243
Secondary edu.	.0237	.4056	.0522	1.4342
Tertiary edu.	.1280	.2260	.0388	.5796
Farming	-.1420**	-.2254	.1003	.7353
Safe water	.0149	.223	.0263	.3552
Safe Toilet	.3761* **	0.744	.0601	2.1223
Idanre FR	-.176	-3.247	-	-
Oluwa FR	-.254**	-1.177	-	-
Oyinmo FR	-.316	-1.964	-	-
Diagnostics	R^2 = .245; Adj. R^2 = .2718		R^2= .4021; Adj.= .3837	

Source: Data analysis result
*, **, and *** = Level of significance at 10 per cent, 5 per cent and 1 per cent

Table 7 shows determinants of welfare in female headed households. Age, household size, marital status, primary education and farming are significant. A unit increase in age and household size increases welfare by 1.4 per cent but reduces welfare by 6.4 per cent respectively. Primary education enhanced welfare by 2.7 per cent and female household heads that were into farming primarily had enhanced welfare (12.8) than men headed households. This may explain why encroachment is increasing since framers were better off; others may also pick interest in farming thereby encroaching into the FR. Forest reserves location also contributed to welfare. Probably forest laws were relaxed for women at Oyinmo FR and Idanre FR by the Forest Officers.

Table 7: Determinants of rural poverty among female headed household

Variable	OLS		Fixed Effects	
	Coefficient	t-value	coefficient	t-value
Constant	1.795***	4.352	-	-
Age	.103	1.307	.014***	3.501
Household size	-.046**	-5.204	-.064**	-5.071
Marital status	-.223*	-2.868	-.301**	-1.082
Primary edu.	.011	.044	.027*	.362
Secondary edu	.084	2.055	.204	2.430
Tertiary edu.	-.136	-1.129	-.232	-2.020
Farming	-.308***	-3.282	.128***	1.384
Safe water	.0149	.223	.0263	.3552
Safe toilet	.3761**	0.744	.0601	2.1223
Idanre FR	.1223 *	1.8432	-	-
Oluwa FR	.1298	1.4115	-	-
Oyinmo FR	.1311***	1.2702	-	-
Diagnostics	R^2 = 2054; Adj. R^2 = .1826		R^2= .4730; Adj.= .3449	

Source: Data analysis result

*, **, and *** = Level of significance at 10 per cent, 5 per cent and 1 per cent

Determinants of rural poverty by forest reserves

Forest reserves encroachment was reported in the three FRs by the CBFMS Committee report (CBFMS Report, 2010). Having established in this study that the people were actually poor which could explain the reason for the encroachment, then examining the welfare determinants is a step in the right direction.

Table 8 below established that age, household size, farming, and safe water are variables that are significant in Idanre FR whereas age, household size, primary education and farming are significant variables in Oluwa FR (see table 9 in appendix). Concerning Oyinmo FR, significant variables include age, gender, house hold size farming and safe water (see Appendix: Table 10). Generally, any effort at reducing encroachment and poverty should take into consideration these factors for any meaningful effect.

Poverty and deforestation linkage

This study has established existence of poverty and its determinants in the forest reserves. Linking poverty to deforestation is the next exercise and this was done by comparing forest encroachment table reported in the CBFMS on biodiversity indices of the FRs with poverty profile obtained in the study for the FRs. This is possible because same data set were used by the committee in writing the report. The annex contains the methodology employed by the committee at arriving at the biodiversity indices (see appendix 3).

The table below is a pre analysed secondary data obtained from the study in 2010. The aim is to compare the biodiversity indices in the FRs with poverty profile obtained in this study to confirm that welfare actually distorted forests in the study area. From table 5 above, it was shown that 39 per cent, 36 per cent and 5 per cent of poverty incidence, depth and severity respectively were obtained. Looking at table 11 below, the number of stem per hectare was lowest in Oyinmo forest reserve, followed by Idanre forest reserve

and finally Oluwa forest reserve which are 232 stem/ha, 432 stem/ha and 468 stem/ha. Again, the determinants of welfare by FRs revealed that farming is a significant variable that influences welfare at Oyinmo FR, a likely reason for the low biodiversity index recorded in the FR.

Table 11: Biodiversity indices for natural forest in the study areas

Indices	Ose-Oba FA	Ondo East FA	Uso-Owo FA	Idanre FR	Oluwa FR	Oyinmo FR	Total
Shannon-Weiner index (H')	2.66	2.54	2.75	2.68	2.73	2.51	3.39
Evenness (E)	0.52	0.51	0.52	0.44	0.44	0.46	0.46
No of species	18	17	19	20	20	17	52
No of families	15	16	12	17	21	15	28
No of stem/ha	168	148	196	432	468	232	1644

Source: CBFMS Report, 2010
Note: FA means natural forest area i.e. free area outside of reserves.

Conclusion

The author believes that welfare issues in rural areas are major challenges for green environment in Nigeria. Threat on environment is perpetrated in the rural areas through activities like agriculture, lumbering etc. as a result of poverty. The study examined poverty profiles and their determinants in three encroached forest reserves. Age, household size, gender, farming and education were found to affect welfare in the area resulting in pressure on the forest reserves.

Since pressure on the environment has been linked to welfare issues in rural Nigeria and social welfare has positive effect on poverty (Fording and Berry 2000), attempts at reducing deforestation in the area and Nigeria at large must incorporate social welfare programs. Though resources have been stretched, international carbon markets can be a succour, carbon trade generated over US$144 billion 1N 2009 according to the World Bank. Government and private investors should invest in innovations that increase efficiency and decouple economic growth from the use of natural resources, energy solutions that drastically lower emissions of greenhouse gases and methods that purify water or increase food production. Advances in these areas would make Nigeria a suitable place (Adger and Jordan 2009). This is necessary to reduce our dependency on oil and enhance Nigeria's relevance in the green economy transformation.

References

Adeola, A.O. 2008. *Food crisis, environmental degradation: possible solutions*. Paper in the college lecture series, College of Agricultural Sciences, Joseph Ayo Babalola Universsity, Nigeria.

Azeez, G. 2008. *The comparative energy efficiency of organic farming*. Paper presented at the colloquium on Biologically Based Agriculture and the Climate, Enita Clermont, France, 17—18 April.

Kenworthy, L. 1999. "Do social-welfare policies reduce poverty? A cross-national assessment." *Social Forces,* Vol. 77, No. 3, pp. 1119-1139.

Bradley, D., E. Huber, S. Moller, F. Nielson and J. Stephens. 2003 "Determinants of relative poverty in advanced capitalist democracies." *American Sociological Review,* Vol 68, No. 3, pp. 22-51.

Buyer, J., and D. Kaufman. 1997. "Microbial diversity in the rhizosphere of corn grown under conventional and low-input systems." *Applied Soil Ecology*, Vol. 5, No. 1, pp. 21-27.

Bamidele, F. S., O. Abayomi and O. Esther. 2010 "Economic Analysis of Rice Consumption Patterns in Nigeria." *Journal of Agriculture, Science and Technology,* Vol. 12, pp. 1-11.

Bationo, A., A. Hartemink, O. Lungu, M. Naimi, P. Okoth, E. Smaling and L. Thiombiano. 2006. *African Soils: Their Productivity and Profitability of Fertilizer Use.* Paper prepared for the African Fertilizer Summit, Abuja, Nigeria, 9-13 June.

Behrman, J. R. and A.B. Deolalikar. 1993. "Unobserved household and community heterogeneity and labor market impact of schooling: A case study of Indonesia." *Economic Development and Cultural Change*, Vol. 41, pp. 461–88.

Berg, A. and J. Hukkinen. 2011. "Beyond effectiveness: the uses of Finland's national programme to promote sustainable consumption and production." *Journal of Cleaner Production*, Vol. 19, pp. 1788-1797.

CBN (Central Bank of Nigeria). 2006. *CBN Statistical Bulletin 2006.*

Dangote, S. 2004. The Potentials and Constraints of Fertiliser Importation and Distribution by Private Sector and a Suggested Market Friendly Alternative to Subsidy Delivery in Nigeria.

Doran, J., D. Fraser, M. Culik and W. Liebhardt. 1987. "Influence of alternative and conventional agricultural management on soil microbial processes and nitrogen availability." *American Journal of Alternative Agriculture II*, No. 3, pp. 99-106.

Douds, D., P. Hepperly, R. Seidel and K. Nichols. 2007. *Exploring the role of mycorrhizal fungi in carbon sequestration in agricultural soil*. Paper 1011

prepared for the American Society of Agronomy Annual Meeting, New Orleans November.

Flaherty, K., G. Ayoola, J. Ogbodo, and N. Beintema. 2010. *Nigeria: Recent Developments in Agricultural Research*. Agricultural Science and Research Indicators (ASTI) Country Note, October 2010.

Ogundele, O. O. and V. O. Okoruwa. 2006. *Technical efficiency differentials in rice production technologies in Nigeria.* AERC Research Paper No. 154, African Economic Research Consortium, Nairobi, April.
.
DFID Research Strategy (2008 - 2013). 2007..Consultation - Africa Country Report for Nigeria, CAPPS, 5 December.

FAO. 1995. *Land and Environmental Degradation and Desertification in Africa*. United Nations Food and Agriculture Organisation, Corporate Document repository No. X5318.

Galvez, L., D. Douds and P. Wagoner. 2001. "Tillage and farming system affect AM fungus formation, and nutrient utilization of winter wheat in a high P soil." *American Journal of Alternative Agriculture,* No. 16, pp. 152-160.

IDA and IMF. 2010. *Preserving Debt Sustainability in Low-Income Countries in the Wake of the Global Crisis.*

Junge, B., R. Abaidoo, D. Chikoye, and K. Stahr. 2008. Soil Conservation in Nigeria: Past and present on-station and on-farm initiatives. Soil and Water Conservation Society.

LaSalle, T., P. Hepperly, and A. Diop. 2008. *The Organic Green Revolution*. Rodale Institute.

Robinson, M. 2009. *The Social Dimensions of Sustainable Development.* World Bank Sustainable Development Lecture Series, World Bank, 22 April.

Mickwitz P., M. Hildén, J. Seppälä, and M. Melanen. 2011. "Sustainability through system transformation: lessons from Finnish efforts." *Journal of Cleaner Production*, Vol. 19, pp. 1779-1787.

Omonona, B.T. .2009. *Quantitative Analysis of Rural Poverty in Nigeria.* Nigeria Strategy Support Programs (NSSP) Background paper, No nssp 009, November 2009.

NEPAD. 2010. *NEPAD-OECD Africa Investment Initiative: External debt in Africa.* Policy Brief No 3., October 2010.

Ogunlela, Y.I. and A.A Mukhtar. 2009. "Gender Issues in Agriculture and Rural Development in Nigeria: The Role of Women." *Humanity & Social Sciences Journal,* Vol. 4, No. 1, pp. 19-30.

Okojie J.A. 1999. *Environmental Resources management and Education in Nigeria: An*

Agenda for change. Annual Lecture Series, Science Teachers Association of Nigeria, 17 February.

Olomola, A 2006. *Competition issues in the Agricultural sector in Nigeria.* Paper Presented at the Regional Conference of the 7Up Project: Capacity Building on Competition Policy in Select Countries of Eastern and Southern Africa. Aha Ethiopian Consumer Protection Association and Consumer Unity & Trust Society (CUTS) International, Addis Ababa, Ethiopia.

Onyeanusi A.E. and A.J. Meduma. 2001. "Biodiversity: A case study of Kanji Lake National Park." In Adeola A.O. , J.O. Okojie and L.O. Ojo (eds.). *Biodiversity of the rainforest ecosystem in Nigeria.* FEPA-UNAAB linkage centre, UNAAB, Abeokuta, pp. 70-85.

Oyekale, A.S. 2007. "Determinants of agricultural land expansion in Nigeria: an application of error correction modelling (ECM)." *Journal of Central European Agriculture*, Vol. 8, No 3, pp. 301-310.

Robinson, M. 2009. T*he Social Dimensions of Sustainable Development.* Lecture presented at the World Bank Sustainable Development Lecture Series, World Bank, Washington, 22 April 22.

Shengen Fan, B. Omilola, and M. Lambert. 2009. *Public Spending for Agriculture in Africa: Trends and Composition.* ReSAKSS Working Paper No 28., April 2009.

Shonekan E.A.O. 1999. *Actualising Vision 2010. The green Agenda.* Paper presented at the First National Summit on Ecology and Environment, Abuja, 11-13 May.

Töpfer,K. 2002. *The adoption of the Judges' Johannesburg Principles on the Role of Law and Sustainable Development*, August 2002.

UNESCO. 2009. *Literacy and gender-focused school management in Northern Tanzania and Northern Nigeria by Engendering Empowerment Education and Equality.* United Nations Girls' Education Initiative

Westing, A.H., W. Fox and M. Renner. 2001. *Environmental Degradation as both Consequence and Cause of Armed Conflict.* Working paper prepared for Nobel Peace Laureate Forum participants, PREPCOM subcommittee on Environmental Degradation.

XiaoHu, Wang. 2011, "Exploring trends, sources, and causes of environmental funding: A study of Florida counties." *Journal of Environmental Management*, Vol 92, pp. 2930-2938.

Honkasalo, A., 2011. "Perspectives on Finland's sustainable consumption and production policy." *Journal of Cleaner Production*, Vol. 19, pp. 1901-1905.

UNFCCC. 2007. *Investment and financial flows to address climate change.* UNFCCC.

UNEP/ WIPO. 2010. *Patents and clean energy: bridging the gap between evidence and policy.* Final report presented at the Copenhagen UN Climate Change Conference and Bonn Climate Change Talks. Bonn, June 2010.

Appendix

Table 8: Determinants of rural welfare among Idanre FR households in Nigeria

Variable	OLS	
	Coefficient	t-value
Constant	2.341***	2.112
Age	312*	1.428
Gender	.120	.325
Household size	-.152**	-2.543
Marital status	-.604**	-1.367
Prim-edu	-.232	-.843
Sec –edu	.421	0.633
Ter-educ	.134	.192
Farming	-.350***	-1.238
Safe water	.085***	2.035
Safe toilet	-.534	-1.151
Diagnostics	$R^2 = 0.3914$; Adj.$R^2 = 0.2167$	

Source: Data analysis result
*, **, and *** = Level of significance at 10 per cent, 5 per cent and 1 per cent

Table 9:Determinants of rural welfare among Oluwa FR households in Nigeria

Variable	OLS	
	Coefficient	t-value
Constant	1.460**	3.033
Age	.122***	.616
Gender	.210	.115
Household size	-.222**	-1.154
Marital status	-.265	-.458
Prim-edu	-.324*	-.654
Sec –edu	1.110	0.541
Ter-educ	.182	.222
Farming	-.171***	-.168
Safe water	.129	2.123
Safe toilet	-.617	-2.143
Diagnostics	$R^2 = 0.2422$; Adj.$R^2 = 0.2018$;	

Source: Data analysis result
*, **, and *** = Level of significance at 10 per cent, 5 per cent and 1 per cent

Table 10: Determinants of rural welfare among Oyinmo FR households in Nigeria

Variable	OLS	
	Coefficient	t-value
Constant	1.362***	1.701
Age	.817*	1.624
Gender	.352*	.144
Household size	-.280**	-1.552
Marital status	-.262	-1.161
Prim-edu	-.210	-.224
Sec –edu	.022	0.633
Ter-educ	.144	.273
Farming	-.561***	-2.329
Safe water	.164***	1.027
Safe toilet	-.431	-1.022
Diagnostics	$R^2 = 0.3254$; Adj.$R^2 = 0.2313$	

Source: Data analysis result
*, **, and *** = Level of significance at 10 per cent, 5 per cent and 1 per cent

Table 11: Socioeconomic distribution of respondents

	Distribution	Frequency	Per centage
Age	20-40	161	40.0
	41-60	206	45.6
	>60	85	18.8
Gender	Male	419	92.7
	Female	33	7.3
Marital status	Married	405	89.6
	Single	47	10.4
Education Status	Primary	161	35.6
	Secondary	49	10.8
	Tertiary	18	4.0
	No formal education	224	49.6
Household size	0	14	3.1
	1-10	339	75.0
	11-20	94	20.8
	21-30	5	1.1
Length of stay	1-20	316	69.9
	21-40	113	25.0
	41-60	13	2.9
	> 60	10	2.2
Primary Occupation	Farming	401	88.5
	Driving	51	1.8
Farm size	0.1 - 2.0 ha	373	88.0
	2.1 - 3.0 ha	43	5.5
	3.1 - 4.0 ha	22	4.9
	4.1 - 5.0 ha	14	3.1

Table 12: Descriptive statistics of variables

Variable	Mean	Std. Deviation
Age of respondents	43.42	11.388
Sex of respondents	0.07	.260
Marital status	1.10	.306
Education status	3.96	2.401
Number of children	4.21	.854
Household size	7.15	1.494
Length of stay	1.37	.652
Primary occupation	1.21	.602
Farm size	0.27	.726
Access to safe water	0.32	.573
Access to safe toilet	0.44	.179
FR. Idanre	2.32	1.395
FR. Oluwa	0.37	.652
FR. Oyinmo	0.09	.445