African Journal of Agricultural Research Vol. 6(17), pp. 4057-4064, 5 September, 2011
Available online at http://www.academicjournals.org/AJAR
DOI: 10.5897/AJAR11.326
ISSN 1991-637X ©2011 Academic Journals

Full Length Research Paper

Proximate determinants of farmers WTP (willingness to pay) for soil management information service in Benue State, Nigeria

G. A. Abu[1]*, T. E. Taangahar[2] and I. D. Ekpebu[3]

[1]Department of Agricultural Economics, University of Agriculture, Makurdi, Nigeria.
[2]Bioresources Development and Conservation Programme, Wuse II, Abuja, Nigeria.
[3]Department of Agricultural Economics, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

Accepted 11 July, 2011

This study seeks to establish the factors that determine farmers' willingness to pay for soil management information service in Benue State, Nigeria and test the hypothesis that socio-economic factors do not have significant effect on soil conservation practices. A multistage cluster sampling technique was used to select 120 farmers from the three agricultural zones in the state. Logit regression model and contingent valuation method (CVM) were employed in holistically eliciting farmers' preference for soil management information in the study. Results of the logit analysis indicate that, the probability of farmers' willingness to pay (WTP) is 1.99 much higher than that of farmers not willing to pay (1.10). The study recommends the documentation and dissemination of indigenous knowledge on soil conservation in the study area.

Key words: Soil management, conservation practice, willingness to pay, soil degradation.

INTRODUCTION

The reaction to farm productivity loss, biodiversity loss, energy crisis, climate change and other environmental problems are notable economic innovations that offer new opportunities for long-term prosperity. These were initially regarded as mutually exclusive to economic activity. Presently, environmental problems are drastically rewriting the rules for national policies (such as the implementation of Integrated Environmental and Economic Accounts (IEEA) or Green Gross Domestic Product (GGDP)), development projects (such as pioneering carbon markets), businesses (such as investing in innovations) and consumers by affecting both the volume and nature of capital flows.

Historical and socio-economic evidence suggest that farmers often respond actively to land degradation, by modifying their farming practices through independent innovation or by adopting conservation practices known elsewhere. Through production decisions, farmers can deplete, maintain or augment soil quality. The nature of the agricultural practices employed, including the production decisions made by the farmers has an impact on soil quality and thus, future flows of soil resource and agricultural production outcomes is reliant upon such flows (Lipper, 2001). Soil management is very important in subsistent farming system given that soil is the major determinant of output. Following the emerging climate change and increasing population density, the farmer is under pressure to manage the soil. Soil management is very technical and scientific. A package of practice (POP) to help solve the soil problem housed in the Benue Agricultural and Rural Development Authority (BNARDA) is commonly referred to as soil management information service.

An increasing need for food, fibre and fuel in Nigeria, push most farmers into adopting exploitative production techniques, and uncontrolled expansion of/or farming of forest and fragile range areas to increase crop output (BNARDA, 2004). According to the Food and Agriculture Organization Statistics Division 2009, Arable lands are cultivated more extensively than before; 89100 kmsq area increase in cropping area between 1976 and 2007. New and often marginal lands are brought into production;

*Correspondent author. E-mail: goddy_master@yahoo.co.uk.

69642 kmsq of forest land lost between 1976 and 2007.

The realization of sustainable agricultural development will require a pluralistic and consultative social framework, (Pluralistic refers to the wide consultation with the stakeholders, farmers in this case with the intent of ensuring their participation in the intervention process. Consultative' as used refers to participatory approaches as against the 'top-down' approaches used in agrarian studies.); that among other things facilitates the exchange of information between dominant and hitherto disregarded groups in order to identify less material and pollution intensive paths for human progress (Munasinghe, 1993). Educational efforts among farmers on the potential impacts of their actions may be necessary in cases where degradation results in a slowly accumulating impact, which only after some continued stress reaches a critical threshold at which significant production impacts are realized. This makes it difficult for farmers to perceive the benefits of early conservation efforts in their farming investments.

Problem statement

Too often, agricultural planners and scientists forget that farmers, best understand their own lands and objectives. While national policy and top–down agricultural development strategies have their place, these may only be implemented through the active participation of farmers. It is the farmers who mobilize their resources and take risks, to assist their crops overcome soil constraints on productivity. Many farmers are aware of land degradation, but their priorities are food production and income generation during the current or next cropping cycle, rather than in the more distant future. This dilemma between short term household security and longer term conservation issues highlights the need for sound policy on soil as a resource base.

Yield levels in Benue State of staple food crops such as maize, millet and sorghum are generally low, and oscillate on the average between 0.5 and 1.2 ton/ha, below achievable yield levels of 4.0 to 5.0 tons/ha (Rockstrom, 1999 and Benue Agricultural and Rural Development Authority, 2004). The challenge, especially in areas of high population density, is to increase food and fibre productivity, without expansion of cultivated lands into marginal or grazing lands.

An increasing need for food, fibre and fuel in the State, push most farmers into adopting exploitative production techniques, and uncontrolled expansion of/or farming of forest and fragile range areas to increase crop output (BNARDA,1996). Farm lands are cultivated more extensively than before; 4697 kmsq area increase in cropping area between 1976 and 1996. New and often marginal lands are being brought into production; 3906 kmsq of grazing land lost between 1976 and 1996, and 237 kmsq of undisturbed forest lost and 237 kmsq of riparian forest lost (Forestry Monitoring Evaluation and Co-ordination Unit, 1998). According to Pinstrup-Anderson and Pandya-Lurch (1994), further expansion and intensification of food production could have a potentially degrading effect on the soil environment.

Farmers in Benue State often mask the effects of soil degradation by converting their land to less demanding uses, or increasing levels of compensating inputs such as applying more fertilizer, adopting intensive land cultivation techniques without replenishing organic matter and producing on new and often marginal land. Improved nutrient cycling can be achieved through the application of organic inputs and the retention of crop residues (Swift and Anderson, 1992). However, in Benue State, little or no crop residue is returned to the soil leading to declines in soil organic matter. Crop residues of cereals and legumes foliage are fed livestock and used as fuel wood on the farm. Avoidance of biomass burning is a management practice that helps reverse soil erosion trends (Hains and Uren, 1990). Land clearing in preparation for ridging is sometimes done by setting fire on grasses and crop residues. At other times during hunting, biomass burning is also practiced. These actions inhibit organic matter build-up in the soil.

The implementation of sustainable development will require a pluralistic and consultative social framework that among other things facilitates the exchange of information between dominant and hitherto disregarded groups in order to identify less material and pollution intensive paths for human progress (Munasinghe 1993). Recently, extension activities in Benue Sate have been enlarged to include the livestock, fisheries and forestry sub-sectors. Soil resource management can also be the subject of research, when technology options are based on research involving maintenance of soil fertility. Educational efforts among farmers on the potential impacts of their actions may be necessary in cases where erosion results in a slowly accumulating impact, which only after some continued stress reaches a critical threshold at which significant production impacts are realized. This makes it difficult for farmers to perceive the benefits of early erosion control in their farming investments.

Financial constraints are a barrier to the adoption of any farm management strategies. The rehabilitation of degraded landscape depends on the costs relative to the value of output or environmental benefits expected. It is essential to consider the financial implications associated with any course of action. Farm level costs associated with soil depletion are quite heterogeneous across varying soil types and cropping patterns as are the costs associated with reversing or decreasing the process of degradation. One difficulty with farmer appreciation of the importance of soil conservation is that, returns on labour and investments are not immediately evident and are often beyond the planning horizon. Disentangling and prioritizing multiple costs and impacts will involve a complex environmental appraisal exercise. This leads to a final consideration in the analysis of soil conservation; the extent to which disinvestments or depletion costs are recognized by the farmers. Where no costs are recognized, there is no incentive to take action; hence the need for appraisal is also defeated.

Objectives of the study

Specifically, the study seeks to:

(1) Examine the socioeconomic characteristics of the farmers in the study area;
(2) Describe soil conservation practices common among farmers in Benue State;
(3) Examine the key factors guiding farmers' adoption of conservation practices.

RESEARCH HYPOTHESIS

The study seeks to test the hypothesis that; socio-economic factors do not influence adoption of soil conservation practices.

MATERIALS AND METHODS

Study area

Benue State is located in the Middle Belt Region of Nigeria. Farming is the major occupation of about 70%, on an estimated arable land constituting about 60% of the total land area (NBS, 2006). The annual average rainfall variation of the state ranges between 1,750 mm in the Eastern region to 1,250 mm in the Northern region per annum. More so, the state vegetation stretches across the rainforest and savannah vegetations. The original climate forest in the state has disappeared, with ensuing natural vegetation now characterized by a mosaic of secondary forest and savannah with rolling hills and grassy open land; induced by farmers bush burning and land clearing acts (BNSG, 2005).

Sampling technique

Multistage cluster sampling technique was used to select farmers. In the first stage, three local government areas (Gboko, Otukpo and Katsina-Ala) were selected. The second stage involves selection of four farming communities from each of the local government areas, giving a total of 12 communities. In the third stage, 10 farmers were selected from each farming community. A sample of 120 farmers was thus randomly selected, and structured questionnaire administered to each farmer.

Data

Data were collected mainly from primary sources. Personal interview was employed during data collection to improve quality of information, while structured questionnaire was used to direct the interview and record responses. The assistance of extension agents greatly facilitated the questionnaire distribution.

Empirical estimation

The logit model which is based upon the cumulative distribution function for the logistic distribution, of the dependent variable, y, represents farmers willingness to pay or willingness not to pay. Other observable socio-economic characteristics of farmers were denoted as x . The goal is to determine the relationship between farmers' socio-economic characteristics, denoted as x and the probability of farmers' willingness to pay for conservation information which is denoted as y. This should yield two regression equations or models. The first regression equation is for farmers not willing to pay or willing to pay but not able to pay (outliers) (WTP = 0). The standard minimum criterion for true willingness to pay being an acceptable willingness to pay amount in this study is 5% of farmers' annual income. The study stipulates that farmers willing to pay more than 5% of their annual income are outliers (not willing to pay):

$$\log \quad p(0/1-p) = f(\beta_0 + \beta_I x_i + u) = wtp \leq 0$$

While the second regression equation is for farmers willing to pay and able to pay (WTP=1):

$$\log \quad p(1/1-p) = f(\beta_0 + \beta_I x_i + u) = wtp > 0$$

The parameters of the model (farmers socioeconomic attributes) were estimated using the method of maximum likelihood. The likelihood function is given by:

$$l(\beta) = \log \quad L(\beta) = \sum_{i=0}^{n} y_i \log(1 - F(-x_i^i \beta)) + (1 - y_i) \log \quad F(-x_i^i \beta)$$

The first order conditions for this likelihood are nonlinear such that obtaining parameter estimates require an iterative solution.

Model specification

Acceptance is modelled in various ways depending on the nature of the decision to accept a variable. Logit and probit are commonly used when the acceptance process is dichotomous. In these models, a functional relation between the probability of acceptance and a set of independent variables is estimated econometrically using the logistic distribution for the logit procedure or the normal distribution for the probit procedure (Mutuli, 2002). Logit model was adopted to analyze factors influencing the farmers' decision to accept improved soil conservation information delivery technology. Following Gujarati (2005), the model is specified as:

$$L_n(P/1-P) = \beta_0 + \beta_1 \chi_1 + ... + \beta_i \chi_i + e$$

Two alternative interpretations to this specification of interest are: first, the binary model is often motivated as a latent (dummy) variables specification. Let there be an unobserved latent variable y_i^* that is linearly related to x where :

$$y_i^* = x_i^i \beta + u_i$$

Where, u_i is a random disturbance, then the observed dependent variable is determined by whether y_i^* exceeds a threshold value:

$$y_i \begin{cases} 1 & \text{if} \quad y_i^* \geq 0 \\ 0 & \text{if} \quad y_i^* \leq 1 \end{cases}$$

In this case, the threshold is set to zero, but the choice of a threshold value is irrelevant so long as a constant term is included in x_i. Then,

$$\Pr(y_i = 1 / x_i, \beta) = \Pr(y_i^* > 0)$$
$$= \Pr(x_i^i \beta + u_i > 0)$$
$$= 1 - F_u(-x_i^i \beta)$$

Where F_u is the cumulative distribution function of u

In theory, the coding of the two numerical values of y (as 0 and 1) is not critical since each of the binary responses represents an event. This restriction yields a number of advantages. Coding the variable in this fashion implies that, the expected value of the dependent variable (y) is simply the probability that y =1:

$$E(y_i / x_i, \beta) = 1 . \Pr(y_i = 1 / x_i, \beta) + 0 . \Pr(y_i = 0 / x_i, \beta)$$
$$= \Pr(y_i = 1 / x_i, \beta)$$

The second interpretation of the binary specification is as a conditional mean specification. It follows that, the binary model can be written as a regression model:

$$y_i = 1 - F(x_i^i \beta) + u_i$$

Where u_i is a residual representing deviation of the binary y_i from its conditional mean. Then,

$$E(u_i / x_i, \beta) = 0$$

$$Var(u_i / x_i, \beta) = F(-x_i^i \beta)(1 - F(-x_i^i \beta)$$

The dependent variable is the natural log of the probability of accepting improved soil management information (P), divided by the probability of not accepting (1-P). This analysis is done for all farmer household heads in general. Estimation of the model is done using the maximum likelihood method. Since the density function of the maximum likelihood method is non- negative, the direction of the effect of a change in independent (X_i) variables depend only on the sign of the β_i coefficients. Positive values of β_i coefficients imply that the presence or increase in X_i would increase the probability of farmers' willingness to pay; while negative β_i values imply the opposite. The socio-economic variables in the model include: age of farmers in years; literacy level of farmers in years; household size in number; labour supply (Hired and family labour in M/day); farm size in hectares; farming experience in years; access to technical information; major occupation; minor occupation; source of capital; access to credit; payback period; interest rate and Off-farm income. The *a priori* expectations of the independent variables are stated as follows; the presence or increasing positive values of age, education, household size, farming experience, access to information, pay back period, and off-farm income, will increase the likelihood of farmers' willingness to pay for soil conservation information delivery technology. Older farmers will want to bequeath rich soils to their off-springs, while a large household size would mean cheaper labour, and an extended pay back period would allow the farmer adjust loan re-payment. The absence or decreasing negative values of labour, a large and increasing farm size, a high interest rate and decreasing access to credit would reduce farmers' willingness to pay for soil conservation information delivery technology. Less available labour would make labour more expensive, while a large farm size would make the farmer take advantage of the assurance game paradigm predictions of non-marginal lands. A very high interest rate will of course reduce net profit. However, variables such as major occupation, minor occupation, and source of capital are conditional, depending on whether the respondent's major occupation is farming or he/she is a civil servant. The farmer could be using personal capital or burrowed capital.

RESULTS AND DISCUSSION

Socio-economic characteristics of farmers in the study area

The modal age of farmers in the study area was 31 to 40 years (Table 1). This is an active age group. The young age grade of 18 to 20 was 18%. This has implication for labour supply in a subsistence labour-intensive system like Nigeria.

Results from the study revealed that 81% of the respondent were male and only 39% were female in the study area. This showed that farming in the study area is dominated by men. The structure of land ownership is skews in favour of men. Women do not take title and ownership of land; hence, farming is male dominated. From Table 1 a significant proportion of the respondents 43% were married compared to 8% who were single. This showed clearly that farming is an activity of married people, although large proportion of divorced and widowed took part in farming as well. The marital status relate directly to household size. The married farmers will have children who will provide family labour for the various farm operations.

Results of the study showed that 15% of the respondents had no formal education. However, 40% of the respondents had secondary education. This implies that majority of the farmers in the area are literate and can easily adopt new technologies to improve production. This result agrees with the findings of Lipper (2001) who reported that the presence of educated people in farming business is great prospect for the enterprise because of adoption of improved technology.

Conservation practices adopted by farmers in Nigeria

Farmers in the study area employed a combination of conservation practices, which is logical because several factors influence soil degradation. Soil conservation practices observable in the study area include; zero tillage, pre-ridging, diversion ditches, organic manuring and conventional practices. Table 2 shows data on the adoption of conservation practices.

The descriptive statistics on farmers' adoption of

Table 1. Socio-economic characteristics of farmers in the study area.

Characteristic	Frequency	Percentage
Age distribution of farmer's		
21-30	22	18
31-40	57	48
41-50	30	25
>50	11	9
Total	120	100
Distribution of farmers by Gender		
Male	81	68
Female	39	32
Total	120	100
Distribution of farmers according to their marital status		
Single	10	8
Married	52	43
Divorced	30	25
Widowed	28	24
Total	120	100
Educational level of Farmers		
No formal	18	15
Primary	30	25
Secondary	48	40
Tertiary	24	20
Total	120	100

Table 2. Adoption rate of conservation practices by farmers.

Practice (s)	Percent (%)
Zero Tillage	9.40
Diversion Ditches	9.40
Pre-ridging and Diversion Ditches	15.60
Organic Manure and Diversion Ditches	15.60
Pre-ridging	21.90
Conventional Practice	28.10
Total	100.00

Source: Field Survey 2006.

conservation practices shows that, 28 percent of farmers still practice conventional farming (which in the study area includes; land rotation and bush fallowing). An amazing 72% of the farmers interviewed adopt soil conservation techniques such as diversion ditches and Pre-ridging mainly to increase soil organic matter content. Findings in Table 1 indicate that farmers' are aware of soil fertility loss; hence their adoption of conservation practices.

Farmers true willingness to pay for soil conservation information delivery technology

As part of efforts to make the econometric exercise successful, it became essential to determine farmers willing and able to pay for soil management information (true willingness to pay). The standard minimum criterion for true willingness to pay being an acceptable willingness to pay amount in this study is 5% of farmers'

Table 3. Farmers true willingness to pay for soil conservation information delivery technology.

Farmer response	Willingness to pay	Percent (%)	True willingness to pay	Percent (%)
Not Willing to pay	6	6.3	26	27.1
Willing to Pay	90	93.7	70	72.9

Table 4. Factors influencing farmers willingness to pay for soil conservation information.

Socioeconomic variable	Regression coefficient	Standard error	Regression t-values
Age	0.26	0.03	7.86
Education	0.34	0.01	23.69
Household size	0.73	0.05	15.42
Labour	-0.66	0.03	-22.58
Farm size	0.11	0.05	2.32
Farm experience	-0.71	0.03	24.04
Access to information	-0.15	0.03	-4.40
Major occupation	-1.33	0.05	-27.20
Minor occupation	-0.32	0.02	-14.59
Source of capital	-0.08	0.01	-6.66
Access to credit	-2.79	0.15	-18.62
Pay back period	-1.02	0.05	-18.78
Interest rate	-0.87	0.08	-11.26
Off-farm income	0.03	0.03	0.91

Analysis of field data, 2006.

annual income. The study stipulates that farmers willing to pay more than 5% of their annual income are outliers (not willing to pay). The result of farmers' willingness to pay is presented in Table 3. Findings show that 20.8% of respondents are outliers that is willing to pay but not able to pay for soil information.

Factors influencing farmer's willingness to pay for soil conservation information delivery

Farmers willingness to pay (WTP) for soil management information is the dependant variable; a proxy variable used for the realization of the value farmers place on knowledge quality. The independent variables in the model are farmers' socioeconomic characteristics which influence farmers' willingness to pay positively or negatively as the case maybe. The model fit for farmers not willing to pay is stated below as:

$$(wtp = 0),\ p = 1.15028 + \beta x_i + 1.3345$$

Where 1.15028 = β_0, and 1.3345 = e for WTP = 0

While farmers willingness to pay is:

$$(wtp = 1),\ p = 1.9924 + \beta x_i + 1.3180$$

Where 1.99 = β_0, and 1.32 = e for WTP = 1.

Only the logistic model is required in the model specification because transformations such as log transformations could make a skewed distribution more normal, reduce variance and increase equality of group (variables). The logit model is specified as:

$$L_n(P/1 - P) = \beta_0 + \beta_1\chi_1 + ... + \beta_i\chi_i + e$$

The practice is to reject normality of model if the standard error value is < - 2 or > + 2. No parameter estimate in this study has values within the rejection range. The highest standard error value obtained being 0.15 and the lowest 0.01. In Table 4, standard error values are observed to be less than half of the β_i coefficient values. This been the secondary criterion for accepting coefficient values.

The first order conditions for this likelihood are non-linear such that obtaining parameter estimates required an iterative solution, which converged after 22 iterations before an optimal solution was realized using the method of maximum likelihood. Interpretation of the coefficient values in a binary dependent variable model is complicated by the fact that estimated coefficients from a binary model cannot be interpreted as the marginal effect on the dependent variable. Note that, since the density function is non-negative the direction of the effect of a change in

Table 5. Summary statistics of factors influencing farmer's willingness to pay (WTP) for soil conservation information.

WTP	Intercept	Standard error	Intercept/standard error
0	1.15	0.13	8.65
1	1.99	0.13	15.27

Source: Analysis of field data, 2006.

independent (x_i) variables depend only on the sign of the β_i coefficients.

Positive values of β_i imply that increasing independent variables would increase the likelihood of farmers willingness to pay for soil conservation information delivery technology (WTP = 1). The independent variables having positive β_i coefficients include; age, education, household size, farm size and off-farm income. Findings indicate that, the presence and increasing positive values of these variables increased the likelihood of farmer's willingness to pay for soil conservation information delivery technology (WTP =1). (Table 5) Although as farm size increases, the farmer is likely to take advantage of the assurance game paradigm predictions of non-marginal lands, and expand his farming activities to include marginal or grazing land. The positive value of β_i for land is in line with *a priori* expectations, which can be explained by the small farm sizes (< 2 ha) of most farmers in the study area. Increasing age of a farmer is sure to increase his farming experience, so also does a higher educational attainment which makes him better informed and willing to pay. Household size is linearly related to family labour which is free and sometimes the only labour source. Naturally, a large household size would mean cheaper labour on the farm. Increasing off-farm income is an alternative source of funds needed to finance conservation practices, stabilize farm income and encourage long-term decisions.

The x_i variables having negative β_i coefficients included: labour, farming experience, access to technical advice, major and minor occupations, source of capital, access to capital, pay back period and interest rate.

These reduced farmers' likelihood to pay for soil conservation information delivery technology. The absence or decrease in available labour will increase prices of labour; reduced farming years, would mean less experience; inadequate information, could encourage dangerous practices, while limited access to credit will constrain farmers into accepting loans at high interest rates. These will reduce farmers willingness to pay for soil conservation management (WTP = 0).

Conclusion

As farmers become aware of the need to conserve soil, they should be assisted with information, implementation and demonstration of the benefits of a production oriented conservation farming (NCA, 2004). It is unrealistic to hope that research will produce a 'breakthrough technology' that will solve all soil degradation problems. Attempts to develop practices that serve both conservation and production needs simultaneously "– overlap technologies" in the terminology of Reardon and Vostili (1992), should be especially encouraged. Soil degradation can be reversed, but the process requires long-term commitment. Information is a major input to sustainable development. At the most micro level, individual households need to be informed of the consequences of particular decision about inputs and outputs. Looked at from the outside, there is also a need to use local knowledge and to observe and counteract constraints that prevent sustainable practices from being used. Extension systems are clearly important in both these aspects. Governments also must be informed.

RECOMMENDATIONS

The study recommends that;

1. Research should be intensified to develop compatible technology for land improvement such as labour saving practices that are higher yielding;
2. Conservation work could also be carried out in the off-season, when the opportunity cost of labour is low;
3. Documentation and dissemination of indigenous technical information about land improvement options among farmers.

REFERENCES

Benue State Agricultural and Rural Development Authority (1996) The impact of Benue State Agricultural and Rural Development Authority. Agricultural and Rural Development in Benue State, pp. 1- 4.

Benue State Agricultural and Rural Development Authority (2004) *2004 Annual Report*. Prepared by planning, monitoring and evaluation unit, pp. 8-13.

Benue State Government (2005). A Handbook of Agricultural Resources in Benue State. Benue State of Nigeria: Oracle Business Limited, p. 7.

Dasgupta P, Heal GM (1979). Economic Theory and Exhaustible Resources. Cambridge: Cambridge University press, pp. 112-116

Food and Agriculture Organisation (2000). Applications of the Contingent Valuation Method in Developing Countries: A Survey. Economic and Social Development Paper 146. FAO: Rome, p. 19.

Food and Agriculture Organization Statistics Division (2009). Resources Statistics - Land. The National Version of FAOSTAT, Country Statistics, pp. 34-41

Forestry Monitoring Evaluation and Co-ordination Unit (1998). Assessment of Land and Vegetation Change in Nigeria between 1975 – 1995. FORMECU Abuja, p. 2.

Garrod GD, Willis KG (1999) Economic valuation of the Environment: Methods and Case studies. Edward Elgar. Cheltenham U. K.

Grepperud S (1997a). Soil depletion choices under production and price uncertainty. Discussion Paper 186. Oslo statistics Norway.

Griffin C, Briscoe J, Singh R, Ramsubban R, Bhatia R, (1995). Contingent Valuation and Actual Behaviour. Predicting Connection to New Water System in the State of Kerala, India. World Bank Econ. Rev., 9(3): 373-396.

Gujarati DN (2005). Basic Econometrics TATA McGRAW-HILL Publishing Co Limited. New Delhi, India, p.b4.

Lipper L (2001). Dirt Poor: Poverty, Farmers and soil resource investment and socio-economic aspects of soil degradation. Economic and Social Development Paper 149. FAO: Rome, pp. 1-3.

Munasinghe M (1993). Environmental economics and sustainable development. World Bank Environment Paper The World Bank. Washington, D.C., p. 3.

Mutuli DA (2002). Impact of conservation tillage technologies on small-holder agriculture in semi-arid lands of Kenya. Unpublished proposal submitted to ATPS Kenya.

National Bureau of Statistics (2006). The Nigerian Statistical Fact Sheet on Economic and Social Development. NBS November, 2006.

National Council for Agriculture (2004), Conservation Agriculture. Proceedings of the 33rd Annual Meeting of NCA. Makurdi Benue State.

Osgood D, Lipper L (2001) Methodological issues in analysing the linkages between socio-economic and environmental systems. Economic and Social Development Paper. No. 149 Rome: FAO.

Pagiola S (1992b). Quantifying the returns to soil conservation in Kenya. Paper Presented at Soil and Water Conservation Society. Baltimore.

Reardon T, Vostili SA (1992). Issues in the analysis of the effects of policy on conservation and productivity at the household level in developing countries. Quantitat. J. Int. Agric., 31: 380-396.

Rockstrom J (1999). On Farm Green Water estimates as a tool for increased food production in Water Scarce Regions. Phys. Chem. Earth (B), 24(4): 375-383.