Evaluating Willingness to Sell Vegetation in the White Volta Basin in Northern Ghana

Abstract

Concepts of ecosystem services have been developed to make explicit connections between human welfare and ecological sustainability for policy, development, and conservation initiatives. Economic concepts such as the distinction between prices and values, and the acknowledgment of their values are context-specific which may change across space and time. Contingent valuation is a survey-based economic technique for valuing non-market resources, such as vegetation. This method is often used to establish the amount people are willing to be compensated for maintaining the existence of an environmental feature such as a tree, shrub, or grass. The level of importance attached to provisioning services as well as cultural services and cultural heritage differ in the rural communities hence different cash values attached. It is often perceived that rural community members do not put monetary value on vegetation, the study is therefore aimed at establishing monetary value rural communities have value for vegetation. The study was conducted in two irrigated and two unirrigated landscapes consisting of about 54 communities and comprising 240 respondents. Participatory Rural Appraisal tools were used. Random Utility Theorywas applied and used for the analysis. The willingness to sell vegetation was significant at a 5% confidence level concerning native, sex, age, education, and household head. Marital status was, however, not significant in all the landscapes.The price trend is observed to be across a landscape, from the catchment to the downstream ecosystem.

Keywords: Contingent valuation, vegetation, ecosystem services, rural community, livelihood

Introduction

Concepts of ecosystem services have been developed to make explicit connections between human welfare and ecological sustainability for policy, development, and conservation initiatives (Daily et al., 2000; MEA, 2005). Even though ecosystem services research is ongoing, systematic approaches to measuring, modeling, and mapping ecosystem services, governance analysis, and valuation are needed urgently. Economic concepts such as the distinction between prices and values, and the acknowledgment of their values are context-specificand may change across space and time (Muradian *et al.,* 2013; Edem *et al.,* 2014).

Local land managers not receiving compensation for the valuable ecosystem services often ignoreresource management issues in their decision-making (Arriagada and Perrings, 2009). This has led to socially sub-optimal land use decisions. The value of ecosystem services, if known, likeother market mechanisms, will induce land managers to incorporate the economic value of ecosystem services into their financial decisions (Rojas and Aylward, 2003; Arriagada and Perrings, 2009).

The benefits of such mechanisms for poverty alleviation and equity lie in the fact that the emergence of market mechanisms for ecosystem services such as carbon sequestration or biodiversity conservation creates new income-generating opportunities for landholders at the same time as they generate efficiency gains. Compensating landholders for the ecosystem service benefits offered is believed to possibly change land use decisions in ways that leave everyone better off.

Contingent valuation, a survey-based economic technique for valuing non-market resources, such as environmental preservation or the impact of contamination, is observed to be suitableto establish the amount people are willing to be paid for maintaining the existence of or to be compensated for maintaining the environmental feature, such as biodiversity in the study area (DEFRA, 2007;Hurford and Harou, 2014; Turner, 1999). In northern Ghana, the appreciation of ecosystem services is varied, depending on the ethnicity of the rural population. The level of importance attached to provisioning services such as food, fibre, fuel, etc. as well as cultural services such as spiritual, recreation (communal hunting, fishing, and swimming), and cultural heritage are necessary for the rural communities and therefore, differ (Edem *et al.,* 2014; Tahulela, 2016; Ryan *et al.*, 2016).

The White Volta Basin comprises irrigated and non-irrigated landscapes, rich with vegetation but gradually being denuded with several small-, medium- and large-scale irrigation schemes. These include large-scale irrigation projects such as Tono, Bontanga, and Sisili-Kulpawn etc. There are also many rich and luxurious vegetative valley bottomssome of which include the Nasia, Nabogo, Fumbisi, and Soo valleys. These valleys are the major source of wild vegetables, fruits, food fodder, and water for both humans and livestock during the dry season. Fulani (both migratory and resident) herdsmen settlements, as well as residents,congregate in these flood plains and valley bottoms during the dry season. The landscapes in the basinconsist of different ecosystems that provide provision, regulation, and cultural services (Turner *et al.,* 2014; Burkhard *et al.,* 2009; MEA, 2005).

Rural population livelihoods and security depend greatly and directly on ecosystem services and goods (MEA, 2005; Somorin, 2010). Ecosystems provide the needed services and have a set of complex interdependent, and functional relationships between soil, crop production, animal husbandry, and forestry services (Fisher *et al.,* 2013).Rural livelihoods in northern Ghana depend on ecosystem services and the degradation of the ecosystems and ecosystem services hassevere impact on the people the demand for ecosystem services has been observed to give rise to competition and conflict among users.

The question is; do rural communities have monetary value for the vegetation apart from the services their livelihood depends on? The objectives of the research therefore are; to determine the importance and monetary values of the types of vegetation to the rural livelihood in the study area,hence evaluate the monetary value farmers are willing to sellvegetation and the price trend of ecosystem services in the landscapes.

Methodology

Study Area

Thestudy was conducted in the White Volta Basin in northern Ghana. The White Volta Basinhas high irrigation potential and the presence of large, medium, and small irrigation schemes and vast valleys and uplands are evidence.The basin is characterizedbyfairly low relief features anda few areas of moderate elevation in the north and east. Large and small irrigation facilities are found in this basin such as Tono Irrigation andBontanga Irrigation Projects and the Vea and Libga Irrigationschemes are in this Basin respectively.The White, Black, and Red Volta and their tributaries run through this basin. Hence the vegetation in the basin is very luxuriant with diverse ecosystems and ecosystem services.

Focus group discussions with a checklist on thematic areas, semi-structured interviews of sampled 240 households,andkey informant interviews were conducted in communities in the landscapes. Contingent valuation (CV) was used to determine the economic value of the vegetation.

Random Utility Theory (RUT) which is appropriate for modeling individuals' behaviour based on choices was used in the analysis (McFadden, 1984). The utility a person derives from a product can be represented as having two components; a utility function of observed characteristics known as the deterministic component of utility and the unobserved component known as the random component. The deterministic component is exogenous and includes individuals' characteristics and product characteristics and a set of linearly related parameters and the random component may result from missing data/variables (omitted variable), measurement errors, and misspecification of the utility function. This function is specified below as:

$$U_{ij} = X\beta + \varepsilon \text{ ……………………………………………………(1)}$$

Where

$X\beta = v$

U_{ij} is the maximum utility attainable when alternative j is chosen by consumer i;

$X\beta$ is the deterministic component of the utility function;

X, a vector of observable socio-demographic and economic characteristics, product-specific factors that influence utility;

β is an unknown parameter vector to be estimated andε is the stochastic term.

Thus, given the above assumptions, the Tobit regression is used to examine individuals' willingness to sell since the dependent variable is continuous but not a dummy. The explicit Tobit regression is expressed thus as:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 \text{ ....} + b_nX_n + u \text{ ………….....................………. (2)}$$

Where

Y = level of respondent's willingness to sell as a percentage (%)

b_1 - b_3 = estimated coefficient

X_1 - X_n = variables of the study

U = error term

Following the above, the individual Tobit regression model for each dependent variable are specified as:

$$Non\text{-}Economic\text{-}Trees_{ell} = \beta_0 + \beta_1 Native + \beta_2 Age + \beta_3 Sex + \beta_4 Edu + \beta_5 Married + \beta_6 HH + \mu$$
$$Fodder/Grasses\ s_{ell} = \beta_0 + \beta_1 Native + \beta_2 Age + \beta_3 Sex + \beta_4 Edu + \beta_5 Married + \beta_6 HH + \mu$$
$$Economic\text{-}Tree\ s_{ell} = \beta_0 + \beta_1 Native + \beta_2 Age + \beta_3 Sex + \beta_4 Edu + \beta_5 Married + \beta_6 HH + \mu$$
$$Shrub/Herbs\ s_{ell} = \beta_0 + \beta_1 Native + \beta_2 Age + \beta_3 Sex + \beta_4 Edu + \beta_5 Married + \beta_6 HH + \mu$$

Interpretation, measurement, and the apriori expectation of the dependent and independent variablesare included in the Tobit regression model.

Willingness to sell vegetation with dependent variables non-economic trees, economic trees, fodder/shrubs and herbs/grasses, and continuous variables such as the type of ecosystem, native, sex, and household head enabled the use of a multi-linear regression model. The evaluation of individuals' willingness to sell vegetation was achieved by the use of the vegetation (economic tree, non-economic tree, fodder/grasses, and herb/shrub) as a continuous variable and enabled the use of the multi-linear regression model (Martín-López *et al.*, 2007). The independent variables in this case were the type of ecosystem, native, sex, age, educational status, marital status, and household head.

Data collected were entered in Excel and also analysed using the Statistical Product and Service Solutions (IBM SPSS) (Hejase & Hejase, 2013). Random Utility Theory was used to determine the factors that influence individual households' decision to sell the vegetation after Contingent Valuation was used to determine the economic value of the vegetation.

Results and Discussions

The vegetation wasputintofour major categories based on their usefulness and value by community members:Economic trees, such as*Vitellaria paradoxa, Parkia biglobosa, etc.,*Non-economic treessuch as*Faidherbia albida, Dichrostachys glomerate, etc.,*Fodder and grasses such as *Andropogon gayanus, Feresia apodomthera, etc. and*Shrubs and herbs such as *Calotropis procera, Combretum glutinosum,* etc.

Respondents'willingness to accept a sell price of the various vegetationreached acceptable pricesthat gave average prices (Table 1).It was observed that in the landscapes, there was variation in the price value of the various materials across an ecosystem. The average price of economic trees was observed in Tono with the lowest in BIP landscape. For herbs and shrubs, the highest of GH¢313.33 was observed in TIP landscape and the lowest of GH¢311.33 in SKIP landscape. Non-economic trees were observed to have the lowest price (Table 1).

The relatively high price of economic trees in TIP landscape may be attributed to the degradation (cutting of economic trees) vegetation in the landscape. In Soo and SKIP landscapes, most respondents referred to the TIP landscape were made to the effects now experienced in TIP and BIP landscapes, which is over harvesting of vegetation.

Table 1: Average Willingness to SellVegetation

Landscape	Economic Trees(GH¢)	Herbs and Shrubs(GH¢)	Fodder and Grasses(GH¢)	Non-economic Trees(GH¢)
BIP	312.00	281.17	228.33	131.67
TIP	313.33	285.00	232.33	130.17
SKIP	311.33	282.67	231.33	132.33
Soo	313.17	284.00	230.83	130.50
Average	**312.46**	**283.21**	**230.71**	**131.17**

Source: Field survey, 2020

There was not much variation in the willingness to sell economic trees within and between landscapes. For instance, for the price of GH¢240, in BIP and SKIP landscapes, 23% of the respondents agreedpositively to this amount while in Soo and TIP landscapes 22% of the respondents were observed. For the price of GH¢270, the majority of respondents (27%) were observed in the BIP landscape this was the highest in TIP, Soo, and SKIP landscapes recording 25% each (Figure 1).

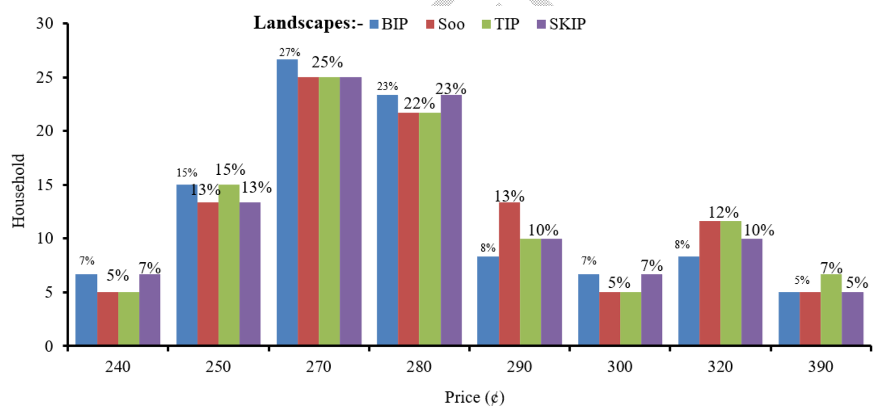

Figure 1: Household Pricing of Economic Trees (Source: Field survey, 2017)

The highest pricerespondents are willing to sell economic trees was GH¢390/tree with 5% of the respondents in BIP, Soo, and SKIP landscapes and 7% in TIP landscape. The lowest price was GH¢240 with 7% and 5% of the respondents in BIP, SKIP, Soo, and TIP landscapes,respectively (Figure1).

Herbs and shrubs have multi-purpose uses such as medicinal, craft, food, fence, ruminant feed, etc. were priced based on a bundle. The highest value of a bundle was GH¢350 and the lowest was GH¢280 in the landscapes (Figure 2). GH¢310 was observed to be the frequent response to the willingness to sell price with 27% and 25% in BIP, Soo, and in TIP, and SKIP landscapes, respectively. Closely followed willingness to sell price was GH¢320 with 27%, 23%, 20%, and 18% of respondents in TIP, SKIP, Soo, and BIP landscape, respectively (Figure 2).

A male respondent (herbalist) explains that "*people in these communities and especially traditional healers attach importance tothe BIP landscape because of the available different kinds of traditional herbs for the preparation of different medicines are not easily found in the other landscapes. Many of the people in my community depend on herbal medicines*"

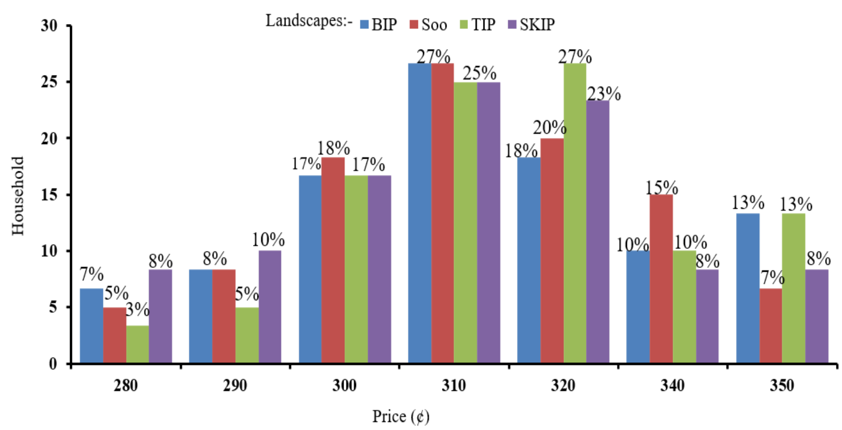

Figure 2: Household Pricing Herbs/Shrubs(Source: Field survey, 2017)

A farmer from the Sisili-Kulpawn landscape noted that 'false yam' (Icacina senegalensis) does not serve as fodder or food but serves to protect the soil and enhance supporting services (mulching, and soil erosion control) and that some trees such as Khaya senegalensis are important because of their spiritual, cultural and medicinal value to the people as noted by Gaoue and Ticktin (2009).

On the willingness to sell fodder/grass, arespondentMr. Alidu Bukari disclosed that there isa stigma attached tothe sale of fodder/grass in the communities, hence the trade is secretly carried out by adults but openly by children. The average price offodder/grass isGH¢230/bundle(Figure 3).

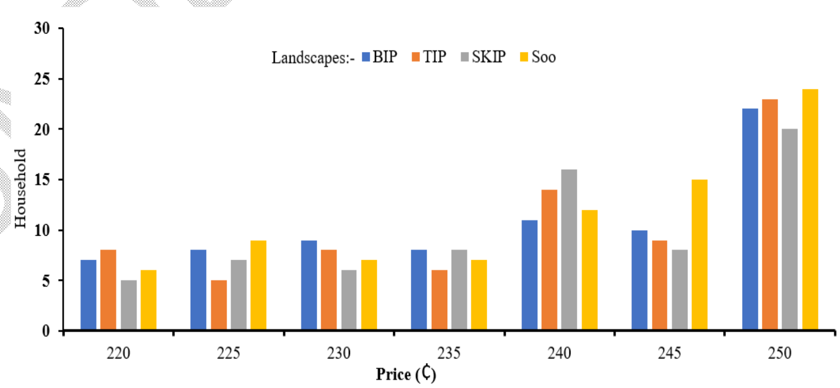

Figure 3: Household pricing of fodder/grass (GH¢/bundle) (Source: Field survey, 2017)

Willingness to sell price of fodder/grass in the study was observed to be very low because of free-range system of livestock rearing. The willingness to sell price depended very much on the proximity to the few available markets and the freshness of the fodder/grass.It was observed that patronage was by non-natives and children contracted by livestock owners from Tamale and Bolgatanga.

A dealer in fodder/grass at TIP remarked:*"Livestock feeding in all the landscapes is free-range, as such buying of fodder is not widely practiced and also, the distance of livestock markets (Navrongo, Bolgatanga, and Tamale) to these landscapes are quite far (averagely 70 km) for easy patronage of fodder hence the high cost."*

Whereas a small ruminant keeper and farmer at SKIP remarked:*'Why should I sell grass when there are plenty in the fields, those who have livestock and are willing to buy fodder/grass from me, I have a price for if only they are ready to pay. I am sorry I cannot leave my farm work and be cutting fodder for them. They should drive their livestock to feed them like the Fulani do. I will only harvest medicinal herbs/shrubs to help the poor (especially women and children) in my community who cannot afford medical care.'*

Non-economic trees are considered not to have monetary value in rural communities but are considered important to their livelihood. Non-economic trees according to Madam Azara Issah, are sources of medicine, energy, fodder, building materials, stakes for agricultural activities, materials for cultural/social needs, etc. in the communities which now have some monetary value.

Non-economic trees were valued between GH¢128 - GH¢144/tree(Figure 4). The majority of the respondents (20 - 24 households) suggested a willingness to sell the price of GH¢144/tree in all the landscapes.At the time of the survey, the selling price was GH¢140 and about 45% of respondents in the landscapes were selling.

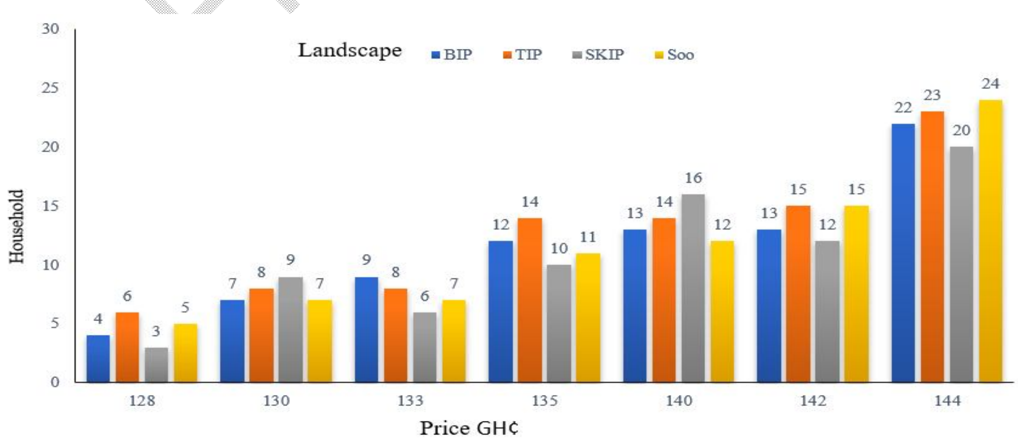

Figure 4: Household pricing non-economic trees (GHS/tree). (Source: Field survey, 2017)

Interpretation of Tobit Analysis of willingness to sell Economic Trees

Native: Respondents on native willingness to sell economic trees was found to have a negative coefficient of 1.680 (Table 2) and is highly significant influence on the willingness to sell economic trees with a P-value of 0.003 at a 5% significant level. This means that natives have high influence on the willingness to sell economic trees. This result is observed to be true in the study communities that the ecosystem resources where livelihood is much depended on economic trees and the management of these resources is by the natives (Berkes *et al.,* 1994; Kasanga and Kotey, 2001).

Sex: Relating sex to a willingness to sell economic trees, a negative coefficient of 1.8734 was observed with a very significant P-value of 0.004 (Table 2). This implies males and females in the study areainfluence the willingness to sell economic trees.

Table 2: Tobit regression results on willingness to sell - Economic Trees

Characteristics	*Coefficient*	*Std. Error*	*T value*	*P-value*
Type of ecosystem	0.4778	1.9118	0.25	0.003
Native	-1.680	11.5332	-1.27	0.004
Sex	-1.8734	.8461	-2.21	0.028
Age	0.0245	.0127	1.92	0.047
Educational status	-0.0193	4.4149	-0.00	0.007
Marital status	1.7029	7.6234	1.54	0.126
Household head	0.0297	9.745048	0.03	0.008
Cons	312.3848	6.2583	49.91	0.000

Number obs=240, F (7, 232) = 0.51, Prob > F = 0.0055 R^2 *= 0.8146 adj R-squared = 0.715*

*Age:*The age of respondents was found to have a positive effect on individuals' willingness to sell economic trees with a positive coefficient of 0.0245. The willingness to sell economic trees at a 5% confidence level was found to be significant at a P-value of 0.047 (Table 2). Implies age influences the willingness to sell price of economic trees in the landscapes.

Educational status: Educational status was found to have a negative coefficient on individuals' willingness to sell economic trees with a coefficient of 0.0193. The willingness to sell economic trees at a 5% confidence level was observed to be significant at P-value of 0.007. Thus, education has influence on willingness to sell economic trees.

*Household head:*The household head was found to have a positive effect on individuals' willingness to sell economic trees with a positive coefficient of 0.0297. At a 5% significant level household head willingness to sell economic is very significant. Implying that household heads has much influence on the decision to sell economic trees in the landscapes.

From the above analysis (Table 2), native, sex, and educational status have negative influence on willingness to sell economic trees (negative coefficients) and only household head has a positive coefficient. The continuous variables were all significant at a 5% significant level except marital status (Table 2).

Interpretation of Tobit Analysis of willingness to sell Non-economic trees

Native: Native responses' willingness to sell non-economic trees resulted in a negative coefficient of 2.6938. Responses from Natives regarding willingness to sell non-economic trees were observed to be significant with a P-value of 0.009 at a 5% significant levelin the study area (Table 3).

*Sex:*Sex (male or female) responses were found to have a positive effect on individuals' willingness to sell non-economic trees with a coefficient of variation of about 1.6025. Sex response to willingness to sell was observed to be significant at significant with a P-value of 0.000.The willingness to sell non-economic trees was significant as the major source of energy in the study area is fuel wood hence the use and willingness to sell non-economic trees by males and females.

Table 3: Tobit Regression on Willingness to Sell - Non-economic Trees

Characteristics	*Coefficient*	*Std. Error*	*T value*	*P-value*
Type of ecosystem	0.0352	0.3704	0.10	0.924
Native	-2.6938	2.2345	-1.21	0.009
Sex	1.6025	0.8471	1.89	0.000
Age	-0.0158	.0200	-0.79	0.001
Educational status	2.3059	.8553	2.70	0.008
Marital status	0.2911	1.47703	0.20	0.844
Household head	1.8734	.8461	2.21	0.028
Cons	132.1674	1.2125	109.00	0.000

Number obs=240, F (7, 232) = 1.96, Prob > F = 0.001 R^2 *= 0.7273 adj R-squared = 0.6559*

*Age:*Respondents' age was found tohurtthe individuals' willingness to sell non-economic trees with a negative coefficient of 0.0158. Thus, agehurts the sale of non-economic trees. It was however observed that age with regard to the willingness to sell is significant with a P-value of 0.001 at a 5% confidence level (Table 3). During the dry season in the study area, the sale of fuel wood, rafters, etc. is very common, hence inducing the willingness to sell non-economic vegetation.

*Educational status:*A positive coefficient of 2.3059was observed with the educational status of respondents. Willingness to sell non-economic trees was observed to be significant with a P-value of 0.008 at a 5% confidence level. Thus, educated respondents have a low coefficientof

2.3059 higher chance of being willing to sell non-economic trees compared to non-educated respondents in the area.

*Household head:*The household head was found to have a positive effect on individuals' willingness to sell non-economic trees with a positive coefficient of variation (1.8734). This means that respondents who are household heads have a high probability of willingness to sell non-economic trees. Household heads from the analysis are observed to be significant with a P-value of 0.028 at a 5% confidence level.

From the above analysis (Table 3) only native and age hada negative influence on willingness to sell non-economic trees (negative coefficients).All the continuous variables were significant at a 5% confidence level except marital status (Table 3).

Interpretation of Tobit Analysis of Willingness to sell Fodder/grasses

Native: Respondents' native was found to have a negative effect on individuals' willingness to sell fodder and grasses with a negative coefficient of variation (7.8203). Willingness to sell fodder/ grasses was observed to be significant with a P-value of 0.008at a 5% confidence level. However, the traditional norms and values in the communities shunthe sale of fodder/grasses.

Sex: Respondents' sex was found to have a positive effect on individuals' willingness to sell fodder/grass with acoefficient of varianceof 0.0637. Willingness to sell fodder/grasses was observed to be significant with a P-value of 0.028at a 5% confidence level (Table 4). Males and females were observed to be actively engaged in harvesting fodder (leaves/fruits of *Faidherbia albida*) in TIP Landscape for sale in Navrongo and Bolgatanga.

Table 4: Tobit regression on Willingness to Sell - Fodder/Grasses

Characteristics	*Coefficient*	*Std. Error*	*T value*	*P-value*
Type of ecosystem	-0.1952	9.9518	1.37	0.021
Native	-7.8203	6.7595	-1.16	0.008
Sex	0.0637	2.0381	1.67	0.028
Age	0.0122	0.0605	0.20	0.009
Educational status	-0.6442	2.587587	-0.25	0.004
Marital status	6.2839	4.4680	1.41	0.161
Household head	4.3383	5.7115	0.76	0.008
Cons	228.3004	3.668011	62.24	0.000

Number obs=240, F (7, 232) = 0.54, Prob > F = 0.003 R^2 =0.7137 adj R-squared =0.6161

Age: Age of respondents was found to have a positive effect on individuals' willingness to sell fodder/grasses with a coefficient of 0.0122. Willingness to sell fodder/grasses was observed to be highly significant with a P-value of 0.009 at a 5% confidence level.

Educational status: Educational status was found to have a positive effect on individuals' willingness to sell fodder/grasses with a coefficient of variation of 2.3059. Willingness to sell fodder/grasses considering the educational status was observed to be significant at P-value of 0.008 at a 5% confidence level.

Household head: Household head was found to have a positive effect on individuals' willingness to sell fodder/grass with a coefficient of 4.3383(Table 4). Willingness to sell fodder/grasses considering the household head was observed to be significant at P-value = 0.008 at a 5% confidence level.

From the above analysis (Table 4) onlyeducational status and native had a negative influence on willingness to sell fodder/grasses (negative coefficients). All the continuous variables were significant at a 5% confidence level except marital status (Table 4).

Interpretation of Tobit Analysis of Willingness to Sell Herbs/Shrubs

*Native:*Native response toa willingness to sell herbs/shrubs was at a negative coefficient of -26.918 (Table 5). Willingness to sell herbs/shrubs wasobserved to be significant at 0.021at a 5%confidence level. Non-natives during the survey were observed to be one of the groups in the sale of herbal medicines in the communities.

Sex: Respondents' sex was found to have a positive effect on individuals' willingness to sell herbs/ shrubs with a coefficient of 7.4822 (Table 5). Willingness to herbs/shrubs by respondents was observed to be significant at 0.043 at a 5% confidence level. Users of herbal medicine were observed in women, children, and other vulnerable groups.

Table 5: Tobit regression result on willingness to sell Herbs\shrubs

Characteristics	*Coefficient*	*Std. Error*	*T value*	*P-value*
Type of ecosystem	-8.1468	1.9210	-4.24	0.000
Native	-26.918	11.5886	-2.32	0.021
Sex	7.4822	4.3933	1.70	0.043
Age	0.5064	0.1692	2.99	0.003
Educational status	-12.7068	4.4361	-2.86	0.005
Marital status	12.1811	7.6601	1.59	0.113
Household head	11.9400	9.7919	1.22	0.004
Cons	312.6432	6.28845	49.72	0.000

Number obs=240, F (7, 232) = 7.36, Prob > F = 0.000 R^2 =0.8576 adj R-squared = 0.7824

*Age:*The age of respondents was found to have a positive effect on individuals' willingness to sell herbs/shrubs with a coefficient of 0.5064 with about 0.003 significance at a 5% confidence level. It was observed in the study communities that the aged (over 45 years) were into herbal medicine preparations might have contributed to the significance.

Educational status: Educational status was found to have a negative effect on individuals' willingness to sell herbs and shrubs with a coefficient of 12.7068 and significance at P-value of 0.005 at a 5% confidence level.

*Household head:*Household head was observed to have positive effect on individuals' willingness to sell herbs and shrubs with a coefficient of 11.9400. Willingness to sell herbs/shrubs was observed to be highly significant with a P-value of 0.004 at a 5% confidence level

As shown in Table 5, only native andeducational status had a negative influence on willingness to sell herbs/shrubs (negative coefficients). All the continuous variables were significant at a 5% confidence level except marital status (Table 5).

It may be concluded that willingness to sell vegetation (economic trees, non-economic trees, fodder/grasses, and herb/shrub) in the study landscapes issignificant at a 5% confidence leveltonative, sex, age, educational status,and household head. It was however observed that marital status is not significant in all the landscapes in the study area.

In the particular geographic location, the original owners of land and properties are the natives and hence they make and take decisions with the lands and its resources (Daily et al., 2000). Though, some scholars attest to the fact that, non-natives may sell properties (vegetative resources) acquired in the land, with the assumption that the landed properties may be taken away from them whenever the need arises because they do not have legitimate claims of the acquired properties (Daily et al., 2000).

Price Trend in Ecosystem Vegetation

It was observed from the data analysis the mean value of the various vegetation respondents are willing to sell varies widely with the means and standard deviations. The trends of price respondents are willing to sell economic and non-economic trees, herbs, shrubs, etc. is best explained by a regression graph (Figure 5). From the graph, it is observed that the willingness to sell economic trees, herbs, and shrubs with fodder and grasses increases down the landscape that is from the catchment to the downstream ecosystems. The willingness to sell the price of non-economic trees however is observed to decrease down the landscapes from the catchment to the downstream (Spangenberg, von Haaren, and Settele, 2014).

These trends may be explained by deductions from responses and graphs (Figure 5) including

- Increase in the willingness to sell price from catchment to downstream in the landscapes.
- Relatively high willingness to sell price to protect cutting of mid- and downstream ecosystems vegetation - herbs, fodder, etc. from degradation.
- The low average willingness to sellpriceof non-economic trees is observed as a result of communities not being able to evaluate the economic potential of non-economic trees.

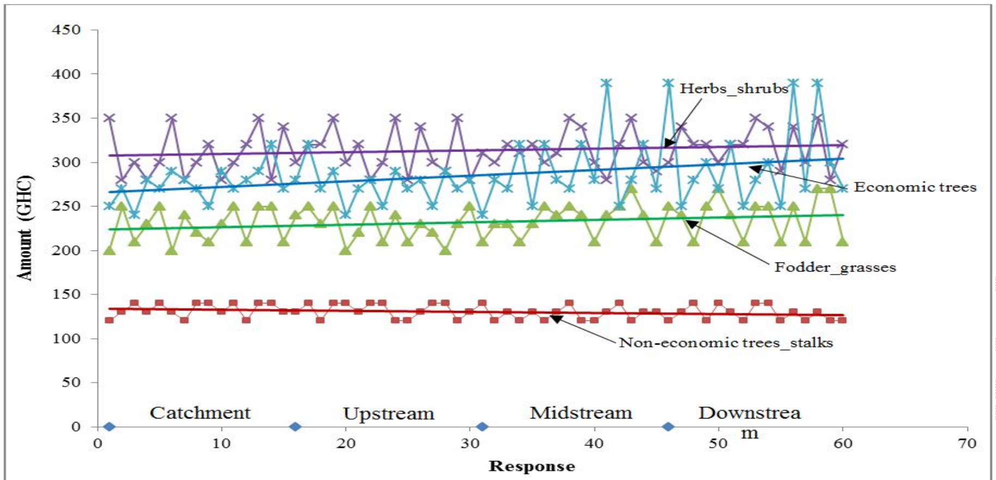

Figure 5: Regression of willingness to sell (Source: Field survey, 2018).

Conclusion

The study's conclusion assertsthatrural farmers in the targeted area have very good knowledge of the usefulness of vegetation to ecosystem services in their environment. However, it was observed that community members do not have much knowledge on the monetary value of vegetation andhence, it is important for awareness creation and up-date onthe monetary value of ecosystem services.

In a rural community, to sell or cut vegetation in the study area, permission must be soughtfrom the custodians (Chiefs, landowners, and tindanas) this was observed to ensure, sustainable use of ecosystem services in the landscapes.The willingness to sell some ecosystem services such as fuel wood and fodder/grass depended on the proximity to markets to the rural communities. It was also observed that native/migrant, sex, age, educational status, and household head have a significant influence on household willingness to sell both economic and non-economic trees

Generally, thewillingness to sell vegetation was significant at a 5% confidence level for native, sex, age, education, and household head. Marital status was, however, not significant in all the landscapes. The price trend is observed to be across a landscape, from the catchment to the downstream ecosystem. The paper may serve as a guide to the valuation of vegetation in rural landscapes by Governments, Institutions,and NGOs in irrigation development projects to consider to the benefits of ecosystem services to rural community livelihood and adopting socio-technical and eco-friendly approaches.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include list the name, version, model, and source of the generative AI technology and as well as the all input prompts provided to a generative AI technology

Details of the AI usage are given below:

1.

2.

3.

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