Journal of Ecosystem & Ecography

Chami, J Ecosys Ecograph 2016, 6:3
DOI: 10.4172/2157-7625.1000210

Research Article Open Access

Roles of Socio-Economic Incentives towards Sustainable Environmental Conservation of Kondoa Rehabilitated Rural Areas, Dodoma, Tanzania

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Abstract

This paper was an attempt to reveal the less known roles of socio-economic incentives towards influencing environmental conservation of rehabilitated rural areas of Kondoa. The cross-sectional research design was employed. Simple random sampling technique was used to select 30 respondents from each of the four study villages and make a total of 120 respondent households. The study was conducted in Mafai, Ntomoko, Kalamba-Juu and Kalamba-Chini villages. Data were collected using pre-tested and pilot-tested questionnaires, focus group discussions and interviews. Ms-Excel and SPSS 20.0 computer software were used to analyze data. Descriptive statistics were employed to reveal various parameters in the study. Binary logistic regression analysis was further employed to reveal statistically significant socio-economic incentives towards sustainable environmental conservation in KRA. The study findings revealed the available five socio-economic incentives namely tree seedlings, fertilizer, improved seeds, beekeeping inputs and education programs. The binary logistic regression analysis further revealed tree seedlings ($P<0.01$), and education programs ($P<0.05$) as statistically significant socio-economic incentives in influencing the awareness of environmental conservation in KRA. The study findings further revealed roles of socio-economic incentives in influencing the awareness of environmental conservation such as afforestation, reduce drought, supportive source of energy, improve yield, increase income, improve food security, control human activities and increase awareness on sustainable environmental conservation in KRA. The study concludes that socio-economic incentives can significantly contribute to the restoration of forest loss and fragmentation hence leading to sustainable conservation of the biodiversity. The study recommends for the conservationists, environmentalists and policy makers to make use of the available five socio-economic incentives namely tree seedlings, fertilizer, improved seeds, beekeeping inputs and education programs in the course of implementing effective environmental conservation measures. However the study sought a high need of highly integrating tree seedlings and education programs in all sustainably practiced environmental conservation initiatives.

Keywords: Socio-economic incentives; Environmental conservation; Rehabilitated rural areas

Introduction

Background information

Historically, environmental conservation strategies in many areas in the world have been dominated by attempts to fence off or reserve areas for nature and exclude people from the reserved areas [1]. According to Guthiga [2] this protectionist approach has been labelled as the 'fortress conservation', 'coercive conservation' or 'fence-fine' and it has dominated mainstream thinking in conservation for a long time. Economic incentives refer to specific inducements designed and implemented to influence government bodies, business, non-governmental organisations, or local people to sustainably and responsibly conserve, utilize and manage environmental resources whereas socio-economic incentives mostly reflect livelihood measures that strengthen and diversify the livelihoods of biodiversity users or residents of biodiversity areas [3]. They aim at influencing people's behaviour by making it more desirable for them to conserve, rather than degrading or depleting environmental quality through communities' course of their livelihoods' activities [4-7].

According to IUCN [6] many of the most biodiversity rich ecosystems and species in Eastern Africa lie in remote rural areas that are physically or financially beyond the reach of government environmental and protected areas agencies. Their conservation depends primarily on the actions of local communities. Meanwhile, many of these communities are poor, must cope with a limited and insecure livelihood base, and often have few alternatives but to depend on biodiversity for their day-to-day subsistence and income. The provision of socio-economic incentives for these community members to conserve biodiversity is of paramount importance since community economic incentives are based on allowing local communities opportunity to benefit from conservation [4,5].

Tanzania has been acknowledged as one of the most important nations in Africa for biodiversity conservation with more than 25% of the Tanzania mainland total area been set-aside as a protected area [8]. The initiatives of allocating protected areas in the country go in line with rehabilitation initiatives which partly enhance the existing biodiversity conservation including Eastern Arc Mountains, Wetlands, Marine and Fresh Water Areas, forest reserves and partly enclose, improve and establish new biodiversity conservation areas including eroded and infertile areas. There have been deliberate initiatives by the government and donors to rehabilitate, restore and promote the recovery of the degraded ecosystems in Tanzania [7]. Towards arresting environmental degradation, a number of national, regional and district level programs were established including the formulation

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Received August 02, 2015; **Accepted** September 07, 2016; **Published** September 11, 2016

Citation: Chami AA (2016) Roles of Socio-Economic Incentives towards Sustainable Environmental Conservation of Kondoa Rehabilitated Rural Areas, Dodoma, Tanzania. J Ecosys Ecograph 6: 210. doi:10.4172/2157-7625.1000210

of the Division of Environment in the Vice President's Office, the National Environmental Management Council (NEMC), and the Land Management Program for Environment Conservation (LAMP) in Babati District. Other programs are the Hifadhi Ardhi Shinyanga (HASHI) project, the Hifadhi Ardhi Dodoma (HADO) project, the Hifadhi Mazingira project (HIMA) of Iringa, the Soil Erosion Control and Agro-forestry Program (SECAP) in Lushoto District, and the Soil Conservation and Agro-forestry Program (SCAPA) in Arumeru District [7].

Hifadhi Ardhi Dodoma (HADO) is a soil conservation project which started in 1973 in several areas of Dodoma Region, aiming at reducing land degradation in rapidly deteriorating areas through physical soil conservation measures such as afforestation, appropriate cultivation methods, control of run-off by contour band construction and planting vegetation in the river beds [9-12]. Among other drastic measures, HADO project evicted all forms of human activities and all livestock from the 1256 km^2 of Kondoa Eroded Areas in 1979 [13,14]. These led to the quick land rehabilitation entailing high restoration of soil fertility and vegetation in the worst affected areas which later became known as Kondoa Rehabilitated Areas [12,15].

Kondoa Rehabilitated Areas (KRA) is among rehabilitated protected rural areas found in the central of Tanzania. The present situation in KRA indicate that they face enforcement and administration inefficiency towards handling exploitation pressures from local communities surrounding the rehabilitated protected areas [12,16]. This is due to the fact that KRA hold the entire source of livelihoods for the surrounding rural communities hence subjects the rehabilitated protected areas to an intensive reliance and dependence on the resources for sustaining their livelihoods [16,17]. In line with weaknesses and deficiencies of the existing command and control measures in place, there has been an experienced rampant increase of unsustainable land-uses and other human activities in the areas [12,16,18].

Moreover, the successful rehabilitation of Kondoa areas attracted many human activities including farming, house building (brick making and burning, building poles, thatch grass, ropes etc.), tree felling for fuel wood and farm expansion, and sporadic grazing of livestock [16,19]. Literatures suggest successful rehabilitation constrains such as over extraction of the available resources, unsustainable land uses and poor institutional framework which exist along the resettlement process have made the resettlement process unsustainable [20,21]. The existing situation in the areas also demonstrates that farmers and livestock keepers grasp quickly whatever chances happen to make use of new land-use opportunities, unlike early 1970s when intensive conservation efforts existed in the areas [16,22].

In contrast to the prevailing situation in Kondoa Rehabilitated Areas, various approaches of environmental management measures have been employed to protect the natural resources and ensure sustainable livelihoods in the area. Traditional environmental management approach namely command and control measures has been practiced unsuccessfully, whereby enacted legislations, policies and regulations in place provided little control on existing rapid human activities and unsustainable land uses [12,15,16]. Equally, the measures implicate minimum legal measures against the offenders on various issues mentioned in the district environmental protection by-laws due to poor and weak institutional framework [23,24]. Meanwhile, application of socio-economic incentives approach of environmental management has been widely used in the area with little knowledge and information on the roles of socio-economic incentives towards sustainable environmental conservation of rehabilitated rural areas, hence the rationale of undertaking this study.

Problem statement

Despite the widely known merits and challenges of economic incentives approach of natural resource management and biodiversity conservation [3-7], little remains to be known on the roles of socio-economic incentives towards sustainable environmental conservation of rehabilitated rural areas. The available literatures substantiate the existing wide understanding of the significant merits of economic incentives measures over command and control measures of environmental management measures [4-7]. It is further asserted that one of the economic incentives' significances is its least-cost efficient means of achieving environmental conservation objectives as they drive up the cost of environmentally harmful social, economic and livelihoods activities and increase the returns from conservation activities [5,6,25,26]. This study was an attempt to explore the little known roles of socio-economic incentives towards influencing sustainable environmental conservation of Kondoa Rehabilitated Rural Areas, Dodoma, Tanzania.

The study findings are appropriate inputs for conservationists, environmentalists and policy makers in designing effective environmental conservation measures. Since some accounts indicate that $REDD^+$ programs have resulted into positive and significant impacts on livelihoods at the household level, the study findings are useful inputs for helping in intensifying impacts of $REDD^+$ projects by making use of socio-economic incentives in socio-economic activities in the rural areas hence scaling-up the provided livelihoods options to communities and household level. Furthermore the derived knowledge widely inputs the initiatives of attaining the Millennium Development Goal seven (7) of ensuring environmental sustainability [27].

Objectives

Main objective: This paper strived to assess the roles of socio-economic incentives towards sustainable environmental conservation of Kondoa Rehabilitated Rural Areas, Dodoma, Tanzania.

Specific objectives:

The specific objectives of this study were:

i. To identify the available socio-economic incentives for improved environmental conservation and livelihoods in KRA.

ii. To assess the factors influencing the awareness of socio-economic incentives in KRA.

iii. To assess the roles of socio-economic incentives for improved environmental conservation in KRA.

Research Methodology

Description of the study area

Location: The study was conducted at Mafai, Ntomoko, Kalamba juu and Kalamba chini villages in Haubi and Kalamba wards respectively. The study villages and its human settlements are bordering Kondoa Rehabilitated Areas. The study area is found in Kondoa District, Dodoma Region in central Tanzania and it is located at $S4^0$ 43" 28' $E35^0$ 50" 2'. According to Mbegu et al. [20], the study area has semi-arid climatic conditions and nearly ten percent of Kondoa District area with about 1256 sq. km. The study area was categorised as being severely degraded, and hence was referred to as the Kondoa Eroded

Area (KEA). This calls sound rehabilitation measures which turned KEA into Kondoa Rehabilitated Area (KRA) [13]. Currently, human activities have been reintroduced in study area with high prevalence of livelihoods activities on the resources from the rehabilitated closed area [20]. The fact that the selected study villages border some of the forest reserves found in Kondoa Rehabilitated Areas was the criteria for the selection of the study villages.

Population: The population found in the villages surrounding Kondoa Rehabilitated Areas is mainly composed of Rangi tribe. Current the study area population is mainly dominated by male who account for 51 of the total population in the area as shown in Table 1.

Economic activities: The successful rehabilitation of the eroded areas which took place in 1970s attracted many human activities including farming, house building (brick making and burning, building poles, thatch grass, ropes etc.), fuel wood and fertile land for farm expansion and sporadic grazing of livestock hence high population and settlement increase [16,19,28]. Subsistence farming is dominant in Haubi and Kalamba wards and it stands as the main economic activity and source of livelihoods. Food crops are maize, sorghum, pearl millet and sweet potatoes while cash crops include sunflower, groundnuts, simsim, finger millet and peas [29]. Livestock keeping occupies the second important position to farming whereas cattle, goats, sheeps, donkeys and chicken are kept by the majority of the households in the area [29]. Of recent, changes of climatic conditions and loss of soil fertility have led to low productivity hence exacerbating poverty among the majority of the households in the area [30].

Research design

This study employed a cross-sectional research design. Under this design, data on the variables of interest were collected more or less simultaneously, examined once, and the relationship between variables determined [31]. The employed study design was advantageous as it was compatible to the available time and resources.

Sampling procedures

Two wards namely Haubi and Kalamba were purposively selected for this study. The study wards which were of two categories; Haubi was in the category of the ward bordering the protected Ikome forest reserves and sometimes referred to be inside KRA and the Kalamba ward was in the category of ward found outside KRA. In considering the time available for conducting the study as well as financial resources available, two villages were randomly selected from each of the study wards to constitute the sampling frame for the study. Using simple random sampling technique of drawing playing cards, four villages were selected from the study wards namely Mafai, Ntomoko, Kalamba-Juu and Kalamba-Chini. The study population was formed of the total number of households from the four randomly sampled villages.

The households were randomly picked from the village register books in which all households' heads were listed. In villages where register books were absent, the names of people residing in the particular village were recorded with the assistance of village leaders from each hamlet and simple random sampling was used through random generated numbers technique so as to avoid bias. Key informants were purposively selected based on the positions they hold in relation to conservation and rehabilitation of KRA. These included HADO staff in KRA, village government chairpersons and executive officers, institutions representatives and village elders from the selected four villages in the study area.

.Wards	Population		Total
	Male	Female	
Haubi	7027	6730	13 757
Kalamba	7023	6965	13 988
Total	14 050	13 695	27 745
Source: URT [40]			

Table 1: Population profile of the Haubi and Kalamba wards in KRA.

Sample size determination

The households residing in each village were randomly drawn from the compiled list of village registers which was used as a sampling frame for the study. The study went across the sampling frame of the total number of the households available in the study area as proposed by the study such that the provided sampling technique gives a standard sample size which could reasonably represent the population in the question.

Boyd et al. [32] recommended a sampling intensity of 5% of total number of households in a study site. Boyd et al. [32] further posits that the study sample size is considered adequate and able to fit statistical analyses if and only if it entails the reasonable proportion of the units from the sampling frame but being not less than 30 units. For the purpose of this study a sampling intensity of 5% was adopted. This was equivalent to 120 households meaning that 30 households were randomly sampled from each of the four villages as presented in the Table 2.

Data collection

Towards addressing the study specific objectives, both primary and secondary data were collected. A combination of both qualitative and quantitative data collection methods were used to achieve triangulation and complementary. The combination also increased the validity of results [31]. Before actual data collection, research instruments were calibrated by pre-testing and pilot testing of the questionnaires in the10 households; five households from each ward where actual data collection was to be done. The analysis of the tested instruments was done to improve the instruments' consistency, validity and reliability.

Household questionnaire survey: Household questionnaire survey was conducted where both closed and open ended questions were used to collect socio-economic, economic incentives, conservation, management and livelihoods-related data. The total of one hundred and twenty (120) heads of households from the study area was surveyed. This method was undertaken to gather primary data from respondents from all of the study villages namely Haubi, Ntomoko, Kalamba Chini and Kalamba Juu.

Key informants interview: A checklist was prepared to solicit information from key informants. A key informant is an individual who is knowledgeable, most informed, accessible and willing to talk about the issues under study [33]. The key informants' interviews were conducted during the data collection process whereby more

Village	Total number of households	5% of the total number of households	Sampled households
Haubi	609	30.45	30
Ntomoko	590	29.5	30
Kalamba Chini	567	25.65	30
Kalamba Juu	496	24.8	30
Total	**2262**		**120**
Source: Estimates from village registers (2014)			

Table 2: Distribution of respondents in the surveyed villages.

than 30 key informants were interviewed from all of the four villages were interviewed to reveal the specific information relating to the use of economic incentives in the KRA. The key informants included in this study were HADO Project Officers, Village Chairpersons, Village Executive Officers and Village Elders.

Focus group discussions: Focus group discussions were employed purposely to explore information from people of different ages, sex and occupation. This technique was complemented by direct observation where some existing features in economic incentives-related environmental conservation practices were observed. According to Kajembe et al. [33] the combination of these techniques is necessary for data triangulation purposes aimed at facilitating validation of data through cross verification from more than two sources.

Towards undertaking FGDs, a group of 5 experienced and knowledgeable individuals who were accessible and willing to talk about the issues under study participated in the study. A checklist was prepared to solicit information from the proposed members. The prepared list of 15 questions which were reflecting the study objectives were posed to the Village Environmental Committee, Village Natural Resources Committee, Village elders and Environmental conservation committees. The detailed discussions were used to reveal important aspects underlying the study and to learn about rural conditions in relation to conservation practices in an intensive and interactive manner.

Literature review: Survey on the literatures related to economic incentives, biodiversity and community participation in conservation was conducted so as to collect secondary data to supplement the primary data. Reports on related studies were gathered from Sokoine National Agricultural Library (SNAL), National Environmental Management Council, The Mwalimu Nyerere Memorial Academy and University of Dar es Salaam Library were the major sources of information and relevant information collected in order to supplement collected primary data. Documented information related to the resource management problems and the useful economic incentives in the environmental and conservation was reviewed including official government documents like the URT [10]. The collected secondary information was used to supplement the collected primary data from the study area. Also environment-related acts, conventions, policies and programmes documents, reports, journals, newspapers, articles, dissertations and all other relevant literatures related to the economic incentives for environmental conservation and management were collected and reviewed.

Data processing and analysis

Data processing: After data collection exercise, primary data were checked for completeness before coding, entering and verification for analysis. The filled questionnaires were cleaned to remove all unintended information and were made ready for coding. The coding process resulted to the data entry exercise. The entered data were cleaned to resemble the collected information. Microsoft Excel and Statistical Package for Social Sciences (SPSS 20.0) computer programs were employed for proper housekeeping, arrangement, management and analysis of the collected data.

Data analysis: Microsoft Excel and Statistical Package for Social Sciences (SPSS 20.0) computer programs were employed for data analysis. Both descriptive and inferential statistical analyses were employed to reveal the aspects relating to socio-economic incentives and environmental conservation practices from the collected data. Data analysis for each objective was rigorously performed, presented and discussed.

***Binary logistic regression model*:** Binary logistics regression has been successfully employed in social sciences, biostatistics, genetics and demographic issues [34]. Other authors including Whitehead [35], Mendoza [36] and Giliba [37] argued that applications of binary logistics regression analysis depend on the nature of the dependent variable of the particular study inquiry. According to Saha [34] the goal of logistic regression is to correctly predict the category of outcome for individual cases using the most parsimonious model. Binary logistics regression technique was used to determine the impact of the independent variables on aspects such as roles of socio-economic incentives towards influencing awareness of environmental conservation.

Binary logistics regression applied in this research is interpreted with respect to the nature of the dependent variables with reference category of the independent variables. According to Pallant [38] and Akankali et al. [39] significant value should be less than 0.05. The independent variables are categorized into two distinct groups based on the discretion of the researcher and study instrument. These two categories were coded into 1 and 0. The category coded 1 therefore becomes the reference category upon which the logit inference is drawn. If the sign of the logit is negative (-ve), this implies less likelihood of the event defined by the reference category occurring. For binary logistic regression, the formula given below as cited from Agresti and Finlay used:

$$Logit(Y) = \ln\left(\frac{p}{1-p}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon_i$$

In this research: P (event= 1) = the probability of the socio-economic incentive to actually improve awareness of environmental rehabilitation conservation activities.

Where,

p = probability of the event,

ln= the natural log

α = the intercept of the equation

β_1 to β_k= coefficients of the predictor variables

X_1 to X_k= The predictors to be included in the logistic regression model i.e., are given in Tables 3 and 4.

Characteristics	Distribution	n	%
Age	20-41 years	45	37.5
	41-60 years	73	60.8
	61 years and above	2	1.7
Sex	Male	72	60
	Female	48	40
Education levels	No formal schooling	37	30.8
	Primary education	50	41.7
	Secondary education	32	26.7
	Tertiary education	1	0.8
Marital status	Single	9	7.5
	Married	105	87.5
	Divorced	4	3.3
	Widowed	2	1.7
Main occupations	Crop farming	42	35.0
	Crop farming and livestock keeping	77	64.2
	Employed	1	0.8

Table 3: Socio-economic characteristics of respondents (n=120).

Results and Discussions

Socio-economic characteristics of respondents

Relevant social-economic characteristics of the 120 respondents who took part in this study include age, sex, education, marital status and occupation. These are summarized and presented in Table 5. Others including household size, income levels and distance from the rehabilitated reserved areas are also presented. Respondents' characteristics were important in order to provide a snapshot on the background of the respondents and their suitability for this inquiry.

Age of respondents: The respondents involved in the study were of different ages. 37.5% of the heads of household in study villages were aged between 20 and 41 years of age, 60.8% of the heads of respondents were aged between 41 and 60 years and 1.7% respondents aged above 60 years old as indicated in Table 3. The fact that most (60.8%) of the heads of respondents were aged between 41 and 60 years and 37.5% of the heads of household in study villages were aged between 20 and 41 years which is considered as the productive or working age, it implies availability of the workforce in various economic and conservation activities. Since the study found that many heads of household in the study villages were aged within the productive age, the study finding is in line with Giliba [37] assertion that most of people found in the study villages can effectively participate in environmental conservation activities, adopt and utilize the economic incentives available in the study area. This suggests that age is useful socio-economic characteristic in influencing sustainable management of biodiversity conservation initiatives.

Also this study finding suggests the availability of supportive workforce for effective and sustainable adaptation and adoption of sustainable environmental conservation initiatives including adoption, participation and utilization of socio-economic incentives. This finding supports Njana's [32] assertion, that the respondents aged between 20 and 60 years provide a workforce in various economic and conservation activities. It further concurs with [40] that the population aged 15 to 64 years entail a working age population hence becoming the community's workforce for various livelihoods activities. Hence the revealed findings suggest the availability of supportive workforce for biodiversity conservation initiatives in study villages.

Sex of respondents: The study sample comprised of both male and female respondents. Results presented in Table 3 showed that, male household heads were 60% of all household heads interviewed in the questionnaire survey while the female household heads were 40% of the all household heads interviewed during the questionnaire survey. The study findings presented in the Table 3 imply patriarchy kinship and it mostly reflect African traditions setting where majority of the households follow patriarchy kinship where by men are the heads of the households and women headed households exists if and only if the women are divorced or separated also when the women's husbands have died. Furthermore the study findings that 60% and 40% of the total households are the male and female headed households respectively suggests the presence of encouraging level of participation in various household responsibilities.

Category	Size in acres
Maximum	8.00
Minimum	1.50
Average	3.8458

Table 4: Farm sizes of the respondents.

Variable	Description
Y	Conservation awareness (0 = Not aware, 1 = Aware)
X_1	Tree seedlings
X_2	Fertilizer
X_3	Improved seeds
X_4	Beekeeping inputs
X_5	Education and training programs

Table 5: Variables used in the logistic regression.

The study findings of 60% and 40% of total male and female respectively in the study area is widely supported by Stiglitz [41]; URT [40] and Njana [32] as they are quite revealing and depicting usefulness of sex of household heads towards adaptation of sustainable environmental conservation initiatives including the adoption of economic incentives in the study area. Stiglitz [41] considered high level of women participation useful towards achieving sustainable development and poverty alleviation through high level of community participation. Also the finding is in line with Ockiya [42] and Adhikari et al. [43], who found that the presence of majority of both sex i.e., 60% and 40% male and female headed households in the study area respectively suggests high level of community participation and hence suggests a supportive condition for sustainable adaptation of sustainable environmental conservation initiatives including the adoption of socio-economic incentives in the study area.

Respondents' education levels: Education level of individuals within a particular community is an indicator of the level of community's human capital. Study findings in Table 3 showed that the education levels of household heads who took part in the study were 30.8% with no formal schooling, 41.7% had acquired primary school education, 26.7% had acquired secondary school education while few (0.8%) of the household heads had acquired tertiary education. The revealed high number of people who had no formal schooling (30.8%) was due to the fact that the number included people with adult education in the study area which entails members of population who had indigenous knowledge which equips them with basic life skills including environmental conservation and seasonal farming.

According to URT [44,45] and URT [45], in Tanzania Demographic Health Survey (2010), poverty level strongly relates to the education levels of the head of households. This implies that the more the household head lacks access to basic education, the higher the possibility he or she becomes poor since education is very important for acquisition of relevant information on skills related to livelihood strategies likewise to engagement to conservation practices. Furthermore, the study findings concurs with what was reported by Kessy [46] and Njana [32] that higher level of education puts households in better understanding of existing livelihood challenges, better decision making ability to choose better alternative solutions to existing problems and undertake household livelihood strategies which are environmentally friendly. Also Maro [47] and Kamwenda [48] argued in line with the study findings that the level of education is considered as an important factor at household level, because, the higher the literacy rate of the household head, the higher the probability the household head is able to make sensible decisions regarding household livelihoods in relation to the sustainable utilization of the available natural resources.

Contrary to what was posited by Lusambo [49] that the higher the education level of the household head the more is the preference of charcoal to firewood as well as other efficient energy sources, the study findings revealed level of education as a contributing factor for people to establish their own tree farms which could sustainably provide firewood. The high literacy level of the household heads

of more than 69.2% revealed from the study area (Table 3) was a sufficient precursor of high level of awareness in many aspects hence becoming an influential socio-economic character which can highly influence the community to sustainably adopt effective and sustainable environmental conservation initiatives including economic incentives in the study area. The revealed respondents' education level was envisaged to be a useful determinant of the level of understanding of the merits and demerits of adopting and utilizing economic incentives.

Marital status of the respondents: The study findings revealed 7.5% of the heads of the households in the study area were single, 87.5% were married, 3.3% were divorced and 1.7% was widowed as presented in the Table 3. The fact that the majority of respondents from the study area were married, the results support the African traditional setting that for the household to exist there should be a couple of married individuals. This implies the presence of families with a good number of children and siblings in a particular community hence an indicator of the level of family workforce to support several economic activities.

Economic activities: The findings reveal that the household heads participated in answering survey questionnaires are mainly engaged in three economic activities namely crop farming, livestock keeping and formal employment. Following the results presented in the Table 3, the following subsections are discussions of the presented results.

***Crop farming*:** The study revealed that 35% of the household heads participated in the study were crop farmers as presented in the Table 3. The average size of the farms owned by the respondents was found to be 3.8458 acres with minimum 1.50 acres and maximum of 8.00 acres respectively as presented in Table 4.

The majority of the households in the study villages were involved in farming maize, beans, sunflower, groundnuts and vegetables. The farming activity in the study area was found to be very subsistent since almost all famers in the study area were found using hand hoes in their farming. This finding is in line with Kessy [46]; Njana [32] and Giliba [32], who found that the majority of farming activities in rural areas is subsistent. This implies high reliance and dependence to other economic activities to support their livelihoods.

***Crop farming and livestock keeping*:** The study revealed majority of the households in the study area (64.2%) were involved in both crop farming and livestock keeping as presented in Table 3. These activities engage many people in the study area as they also apply in-house livestock feeding system. In-house livestock feeding system was reported to be practiced by using the residuals from the harvested crops from the owned farms to feed livestock. The in-house livestock feeding system reduces the encroachments to the forest reserves in the study area.

The study found that the number of livestock allowed to be kept in the particular households was 4 cows and 6 goats, the tendency which was instituted in the study area since the existence of HADO project in 1973[1]. The revealed findings from the study area are in line with Ogle et al. [50] and Kangalawe [14] who reported that the controlled forms of human activities in the then Kondoa Eroded Areas in 1979 had made significant contribution to the conservation initiatives. The prevailing controlled environment for all forms of human activities which has been laid by the HADO project provides sustainable conditions for sustainable environment conservation in the study area [37].

***Formal employment*:** The study found 0.8% of the total number of households in the study was engaged in the formal employment as presented in Table 3. The formal employed respondents were teachers and executive officers at wards and village levels. Despite of being formally employed the respondents were engaged in the subsistent farming and rearing of livestock for supporting their livelihood needs since they were done in the households premises. The study findings on the prevailing main activities in the study area concurs with what was reported by Abdallah et al. [51] that, farming employs over 80% of the rural households (Figure 1). The reported 0.8% of the households' heads who are engaged in the formal employment implies that farming is the dominant livelihoods activities for the majority of the community members in the study villages.

The available socio-economic incentives in Kondoa rehabilitated areas

The study strived to assess the available socio-economic incentives for improved environmental conservation and livelihoods in Kondoa Rehabilitated Areas in the course of attempting the first objective of the study. The study findings revealed various incentives available for biodiversity conservation and improved livelihoods in the study area. The fact that the socio-economic incentives under study meant specific inducement designed to influence local people to conserve biological diversity or to use its components in a sustainable basis, the study has shed light on mainly available socio-economic incentives and which are actually practiced in the study area.

Available socio-economic incentives in Kondoa rehabilitated areas: Socio-economic incentives practices have taken place in the area in form of creation and adoption of new technologies which were needed to systemically change consumption and production patterns, and might entail significant price corrections; encourage the preservation of natural endowments; reduce inequality; and strengthen economic governance of the communities in the area hence sustainable conservation. The study revealed five main socio-economic incentives available in all of the four study villages in Kondoa Rehabilitated Areas. The reported prevailing socio-economic incentives are provision of tree seedlings, fertilizer, improved seeds, beekeeping inputs and education programs. The number of respondents who were aware on the given socio-economic incentives is presented in the Figure 2.

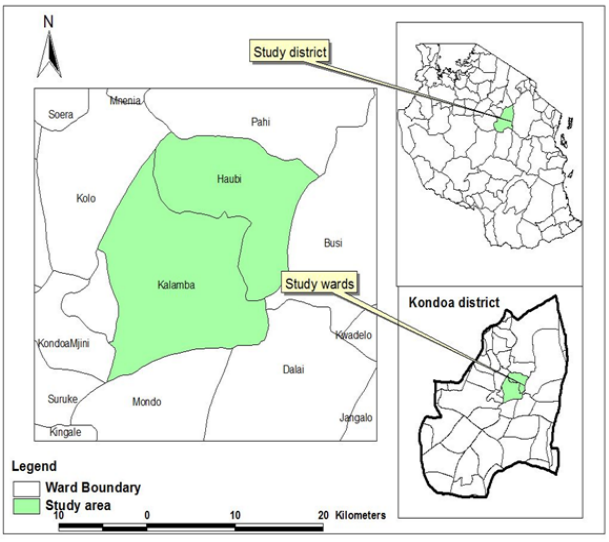

Figure 1: Map showing location of the study area.

[1]Hifadhi Ardhi Dodoma (HADO) is a soil conservation project which started in 1973 in several eroded areas of Dodoma Region.

The existence of the HADO project in the study area since 1973 has provided a base for the existence of environment conservation initiatives including socio-economic incentives in the area. This has helped in reducing the rate of encroachment in forest reserves and other protected areas hence attaining sustainable environment conservation in the study area.

***Tree seedlings*:** Tree seedlings serve as an important component in tree planting. The study found the supply of tree seedling to the communities as the main incentive towards encouraging them to participate in tree planting and hence biodiversity conservation in the study area. The fact that tree planting serves a number of ecological and service functions in the ecosystem, it has been reported by 90 percent of the respondents in the study area as presented in Figure 2. The supply of free tree seedlings influence respondents to plant or retain trees since rural communities have little financial and material resources for preparing their own tree nurseries.

The study findings concur with findings by Lalika [52], who reported that there was a positive correlation between supply of free tree seedlings and the number of planted trees. It was also further posited that, despite the significance of tree seedlings towards environmental conservation, the too little resource available to afford the costs of tree nursery inputs (such as tree seeds, polythene tubes and watering canes) constrains the initiative as it is directed to cover subsistence needs in majority of rural areas.

Furthermore, the findings are similar to the findings reported by Kiwale [53] and Butuyuyu [54] who found that tangible incentives in form of free tree seedlings significantly influenced the number of planted trees in Magu and Same districts respectively. The respondents in the study area reported that tree seedlings increase the willingness of people to plant more trees if they are supplied free of charge. The supplies of free tree seedlings in the study area was found to influence many farmers and other community members to plant trees in their farms and reduce reliance on natural forest products. It was also found to earn income from selling the tree seedlings for the few individuals who had private tree nurseries as one seedling was worth up to 1000 TAS depending on the age, size and height.

Fertilizer: The study found that the supply of fertilizer to the communities in the study area could serve as an incentive since the community is composed of more than 99% people who are engaged in farming related economic activities as presented in Table 3. It was found that 26.7% of the respondent from all of the study villages prefer fertilizer as it is useful in improving their crop yield and hence income. This study finding is concurring to Giliba et al. [37] that the inadequate land for producing sufficient food to feed a mean household size of 6 individuals requires technology for improving the land productivity. Besides, it was observed that the use of fertilizer results to good harvests and hence being one of the plausible reasons for encouraging the small sizes of cultivated land and meeting the rapidly growing population needs in the study area.

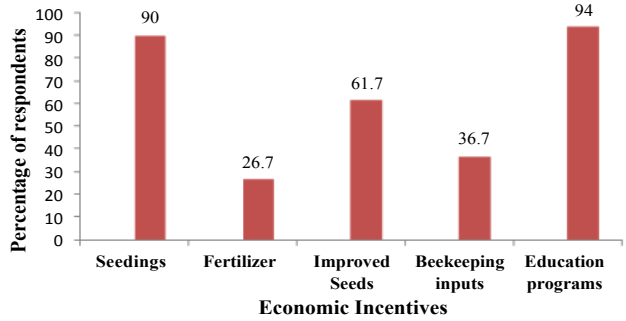

Figure 2: Available economic incentives in the study area.

***Improved seeds*:** Improved seeds were found as a useful economic incentive by 61.7% of the respondents in the study area. The fact that 99% of all people are engaged in farming related economic activities, improved seeds could be useful in improving farming yield and hence raising productivity and income. The study finding are similar to that by Lalika [52] and Giliba et al. [37], who reported that that improving farming technologies for farmers essentially makes them not relying too much to the expanding farming lands to the forest reserve. The study finding suggests that supplying improved seeds to the communities can serve as an incentive. Since the improved seeds increase yields from the same farm sizes, the communities continue cultivating the existing land sizes without expanding them to the forest reserves. The adoption of the improved seeds can work as one of technological interventions towards improved farming productivity in the study area hence resulting to the improved livelihoods and environmental conservation initiatives.

***Beekeeping inputs*:** The study findings revealed beekeeping inputs as a useful economic incentive as 36.7% of the respondents involved in the household questionnaire survey mentioned it to be useful in their areas. Honey collection was one of the economic activities undertaken in some of the areas in the study villages. Beekeeping and honey hunting were practiced in most of Mafai and Ntomoko areas as they have a long history of traditional beekeeping and honey hunting practice. Beekeeping and honey hunting was found useful in both conservation and improving livelihoods in the study area as they were done in the general land forests, protected areas, farmlands and woodlands.

The study finding concurs with the Kowero and Oktingati [55] and Fischer [56] findings that beekeeping and honey collection activities in the forest reserve are friendly activities which encourage regeneration of plant species as they also protect forest from degradation in the same time. However, honey collection was not an important income generating activity in the study area, as local people are not mainly practicing beekeeping but if well promoted and modernized beekeeping inputs can work positively towards improving conservation practices and income generation for the livelihoods for the communities surrounding the forest reserve.

***Education and training programs*:** Education and training programs were found to be useful socio-economic incentive towards making people engage in environmental conservation practices. The study findings revealed 94% of respondents mentioning it as useful socio-economic incentive as presented in Figure 2. According to Benabou et al. [57], education and training programs are non-monetary incentives that may include study tours and short courses. Like monetary incentives, the purpose of non-monetary incentives is to encourage individuals, communities or organizations to carry out conservation activities sustainably. Sometimes non-monetary incentives are given as reward to individuals, communities and organizations for excellent job performance. Education and training programs is provided to raise level of awareness and build up their capacity to be able to undertake conservation practices sustainably.

These findings agree with observation by Bakengesa and Ndomba [58] studies which indicated the need of education programs in influencing level of awareness of the community to be able to adopt newly introduced interventions. This was vividly found in many

aspects relating to economic incentives that tree seedlings and nursery management, use of improved seeds and fertilizers require a certain level of understanding to be workable for the community to conserve sustainably. Furthermore, Giliba et al. [37] findings were similar to the study findings, that regular education and training programs widen awareness on management of the forest reserve among the actors and the community itself. Awareness on reserve boundaries and the economic activity required to be carried becomes a potential socio-economic incentive for impacting the quality of the forest.

Statistically significant socio-economic incentives influencing the level of awareness on environment conservation in KRA

The study strived to reveal statistically significant socio-economic incentives influencing the level of awareness on environment conservation in KRA. Towards revealing the statistically significant socio-economic incentives influencing the level of awareness on environment conservation in KRA, binary logistic regression model was employed. The socio-economic incentives revealed in the study area were entered sequentially in the binary logistic regression model, checked and the insignificant factors were removed from the prediction model as presented in the Table 5. The model was purposely employed to assess the significant socio-economic factors influencing the level of awareness on environment conservation in the study area.

From the previous sections, it was postulated that the five main socio-economic incentives were available in all of the four study villages. The adoption of socio-economic incentives namely tree seedlings, fertilizer, improved seeds, beekeeping inputs and education programs was high due to the existence of the HADO project in area. The study further revealed the incentives being practiced by the study respondents in the area in an average time of 16 years. The successfully adoption of specific economic incentive had various roles on environmental conservation hence serving as a potential attempt towards controlled biodiversity degradation in the study area.

The goodness of fit of the model was found to fit well with the findings of this study (88.8%). A chi-square value of 67.88 with a degree of freedom of 7 was highly significant at 5% probability level ($P<0.001$), meaning that the dependent variable was affected by the independent variables (socio-economic incentives) presented in Table 5.

From the variables employed in the binary logistic regression model namely tree seedlings, fertilizer, improved seeds, beekeeping inputs and education programs, the binary logistic regression analysis revealed only two statistically significant economic incentives namely tree seedlings and education programs. Similarly to Powers and Xie argument as cited by Lusambo [49] argued that the non-zero Wald statistic values indicate the presence of relationships between the dependent and explanatory variables, hence the binary logistic regression analysis employed in the study found tree seedlings and education programs being statistically significant towards influencing the awareness of environment conservation in the study area.

Tree seedlings: Basing on the results presented in the Table 6, provision of tree seedlings has shown to have high influence towards enhancing environmental conservation awareness in the study area. The adoption of tree seedlings as an economic incentive was reported to be high in the area as it was observed from the presented binary logistic regression results in Table 6. This has made people in the area to closely link them with environmental conservation initiatives in the study area. The fact that tree seedlings were found statistically significant at 5% level ($P<0.05$) towards influencing the awareness of environmental conservation initiatives among the communities surrounding KRA, it has been an adoptable intervention in KRA since the inception of HADO project in the area.

Education and training programs: The study findings revealed environmental education and training programs to be useful in influencing environmental conservation in the areas. It was showed to be statistically significant at 5% level ($P<0.05$) as presented in the Table 6. This study finding is in line with Ndomba [58] assertion that education and training programs are useful towards equipping people with skills and know-how of adopting any newly introduced interventions. The fact that most interventions involve laws and regulations designed to benefit individuals and communities involved in conservation projects, environmental education and training programs set in place general enabling conditions that will make them change their economic behaviours. It is also consistent to FAO [59] and Emerton [60] assertions that environmental education and training programs stand as indirect incentives which are also the mechanisms that are targeted to specific objectives and encourage people to conserve biodiversity by providing fiscal, economic and social rewards for their changed behaviour.

Roles of economic incentives on environmental conservation

Since economic incentives are termed as specific inducements designed and implemented to influence government bodies, business, non-governmental organisations, individuals or communities to sustainably participate in biodiversity and environmental conservation and management as it has been widely postulated in IUCN [6], they influence people's behaviour by making it more desirable for the surrounding communities' to conserve, rather than to degrade or deplete, environment resources in their course striving for the livelihood activities. As stated in earlier sections, the existence of the HADO in the study area since 1973 has provided a base for the existence of environment conservation initiatives including socio-economic incentives in the area. The revealed roles played by socio-economic incentives are presented in Table 7. This has highly helped in reducing the rate of encroachment in forest reserves and other protected areas hence attaining sustainable environment conservation in the study area.

Economic incentives have taken place in the area in form of creation and adoption of new technologies which were needed to systemically change consumption and production patterns, and might entail, inter alia, significant price corrections; encourage the preservation of natural endowments; reduce inequality; and strengthen economic governance of the communities in the area hence sustainable conservation. Provision of socio-economic incentives to the local communities residing adjacent to forest reserves is a strategy for enhancing biodiversity conservation. The organizations provide socio-economic incentives as motivations for effective local community involvement in conservation activities outside forest reserves. The basic aim of setting in place socio-economic incentives for biodiversity conservation is to influence people's behavior by making it more desirable for them to

Variables	B	S.E.	Wald	Sig.	Exp(B)
X_1	4.238	1.422	8.878	0.003**	0.392
X_2	15.364	6519.279	0.000	0.098	45.62
X_3	1.640	1.381	1.410	0.235	5.156
X_4	-3.091	1.791	2.979	0.084	0.045
X_5	-.861	1.602	6.289	0.041*	0.423
Constant	-36.372	13038.559	0.000	0.998	0.000
*Statistically significant at α=0.05; **Statistically significant at α=0.01					

Table 6: Roles of economic incentives in environmental awareness in KRA.

Role	Economic Incentives Perceived Roles in %				
	TS	IS	FERT	BI	EDU
Afforestation	61.4	-	-	11.3	4.7
Reduce drought	17.3	-	-	-	-
Supportive source of energy	11.0	-	-	-	-
Improve yield	-	71.7	38.3	9.7	-
Increase income	5.3	10.9	-	61.7	4.3
Improve food security	-	17.4	61.7	-	-
Control human activities	6.0	-	-	21.3	9.2
Increase awareness	-	-	-	21.3	81.8
TS=Tree seedlings; IS=Improved seeds; FERT=Fertilizer; BI=Beekeeping inputs; EDU=Education and training programs					

Table 7: The roles of the revealed economic incentives.

conserve, rather than degrade or deplete biodiversity in the course of their economic activities [61,62].

However, the revealed socio-economic incentives contribute to the restoration of forest loss and fragmentation and consequently leading to sustainable conservation of the biodiversity they play the following roles: Afforestation, Reduce drought, Supportive source of energy, Improve yield, Increase income, Improve food security, Control human activities, Increase awareness as their perception responses are presented in Table 7. The study findings align the Lalika [52] findings on the application of socio-economic incentives in reducing the problem of biodiversity loss in Uluguru Mountains Forest Reserves, such that more or less the same roles revealed by this study were significantly played by the socio-economic incentives in the Uluguru Mountain Biodiversity Conservation Project (UMBCP) under Wildlife Conservation Society of Tanzania (WCST), Uluguru Mountain Agriculture Development Project (UMADEP) and the Morogoro Regional Catchment Forest Office towards carrying out biodiversity conservation activities in Uluguru Mountains [63]. The existence of HADO project in the study area imposed the same towards realizing the usefulness of the socio-economic incentives [64,65].

Conclusion

This study was an attempt to reveal the roles of socio-economic incentives towards sustainable environmental conservation of Kondoa Rehabilitated Rural Areas, Dodoma, Tanzania. The study findings conclude the available five socio-economic incentives namely tree seedlings, fertilizer, improved seeds, beekeeping inputs and education and training programs. Also the study through binary logistic regression analysis revealed tree seedlings and education and training programs as statistically significant socio-economic incentives in the course of influencing the awareness of environmental conservation in the area, hence tree seedlings and education and training programs being the most useful socio-economic incentives in influencing the awareness of environmental conservation in rehabilitated rural areas. The study findings further conclude that socio-economic incentives can significantly contribute to the restoration of forest loss and fragmentation hence leading to sustainable conservation of the biodiversity as they mainly play the following roles: afforestation, reduce drought, supportive source of energy, improve yield, increase income, improve food security, control human activities and increase awareness on sustainable environmental conservation in Kondoa Rehabilitated Rural Areas.

Recommendations

Based on the study findings, the following recommendations have been put forward

i. The conservationists, environmentalists and policy makers should intensively make use of the available five socio-economic incentives namely tree seedlings, fertilizer, improved seeds, beekeeping inputs and education programs in the course of implementing effective environmental conservation measures.

ii. There is a need to deliberately apply socio-economic incentives for the communities surrounding rehabilitated rural areas to mostly capacitate them with an in-depth understanding of how to utilize tree seedlings and education and training programs since they mostly influence community level of environmental conservation awareness.

iii. There is a need of highly integrating tree seedlings and education programs in all conservation initiatives since they raise awareness and paves the way for the community to sustainably practice environmental conservation initiatives.

Acknowledgements

I am indebted to my employer, The Mwalimu Nyerere Memorial Academy for all kinds of support to me during the time of undertaking of this study. I am highly indebted to all respondents in the study area but not limited to heads of households, Haubi and Kalamba Ward Executive Officers, Mafai, Ntomoko, Kalamba-Juu and Kalamba-Chini Village Executive Officers as well as Kondoa District Conservation Officers. Their cordial cooperation rendered to me during data collection is highly appreciated. However, my heartfelt gratitude is due to my lovely wife Mary and our son Ansbert for their passion and endurance during the time of undertaking of this study.

I owe so much-and therefore am exceedingly grateful to my supervisor Professor John F. Kessy of the Department of Forest Economics of Sokoine University of Agriculture for his outstanding guidance, advice, assistance, encouragement and constructive criticism throughout the preparation of this study and my entire Master Degree program at Sokoine University of Agriculture. I am also indebted to the staffs from the Forest Economics Department who supported my learning tirelessly. The friendly and brotherly guidance, directives and courage from Prof. Ngaga, Y.M., Prof. Abdalah, J.M., Dr. Lusambo, L.P., Dr. Mombo, F. and Mr. Nyamoga, G. Z. were very useful towards accomplishing my study. Last but not least, the brotherly support from Prof. Dos Santos, S. and Mr. Kilawe, C. during the time of undertaking this study; their tireless efforts, energy, courage and inspiration including shaping my study theme and subsequently editing my questionnaires prior to field work data collection, to them I am indebted heartfelt appreciation!

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