Adoption of Land Conservation Methods in Kondoa Eroded Area, Central Tanzania

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Abstract: Adoption of land conservation measures is examined in Kondoa District central Tanzania. Three villages, Haubi, Bolisa and Mondo located in Kondoa and Chemba Districts respectively were selected to accomplish data collection. Research approaches employed in this study ranged from historical and ethnography, descriptive and analytical survey. Data were collected using participant observation, in-depth interviews of key informants, key informants’ interviews with village officials, face-to-face household questionnaire survey, documentary review and focus group discussions. SPSS was used to process household data, whereas data were analysed using content analysis and Chi-square techniques. Findings suggest varying promising reasons in adoption of various land conservation measures e.g. tree planting, contour farming and zero grazing. The study recommends that local governments in Kondoa District, with a little support from outside, uphold adopted land conservation measures.

Keywords: adoption; land conservation measures; HADO.

1. Introduction

Land degradation such as soil erosion is a major problem especially in semiarid areas like Kondoa eroded area (KEA) of Kondoa District in Tanzania (URT, 1995; Ligonja and Shrestha, 2015). According to Mwakipesile (2014), land degradation is recurring in Central Tanzania with diverge of success and
failure of varied land conservation projects. Likewise, a long history of promoting improved soil management practices to land users in sub-Saharan Africa had mixed but generally disappointing results (Mcdonagh and Semalulu, 2014; Mugwe et al., 2009).

Factors for adoption of land conservation measures are varied over space and time. The explanation is that some of the deciding factors are dynamic and require therefore, a shift from static to a dynamic observation (Dimara and Skuras, 2003). Typically, less attention is paid to why some of the adopted technologies are discontinued by farmers after their decision to adopt and the programme support stops (Bizoza, 2014). Measures to arrest land degradation in Africa had also ranged from technical, mechanical to administrative (Kikula et al., 1999). These differences could not be attributed to differences in agro-ecological or socio-economic setting but mainly reflected the preferences of donors and project staff for short-term successes and/or long-term sustainable success (Bodnar et al., 2006).

Farmers take several steps before deciding whether to adopt erosion-control measures (Bodnar et al., 2006). They have to be aware of the problem i.e. recognizing erosion symptoms and experiencing the negative effects. They have to be willing to do something about it (perceived urgency of the problem, land rights). They have to know about possible solutions e.g., knowledge and skills to install erosion control measures, belief in benefits. Farmers may be hindered by the complexity or the social acceptability of the measures, by limited access to the necessary inputs, or they may be discouraged by the expense, the low financial returns or the high risks involved (Napier, 1991).

Hence, varied factors distinguish initial adoption from sustained adoption. Initial adoption, or the adoption decision, is mainly determined by the capacity of the farmer to install erosion control measures and by secure land rights, while sustained adoption and the adoption intensity are determined more by the costs and expected benefits (Gebremedhin and Swinton, 2003). Sustained adoption after initial adoption is an important indicator of the success of a project. Rates of adoption of newly promoted practices are usually low, dissemination and uptake beyond the area of direct activity is often poor and the sustainability of management changes once the promotion activity has ended is typically quite fragile (Mcdonagh and Semalulu, 2014).

This study examined community’s perception towards adoption of land conservation measures in Kondoa Eroded Area.

2. Materials and Methods

2.1. Study Area

This study was undertaken in Kondoa District of Dodoma Region. Kondoa District is located in the northern part of Dodoma Region and lies between latitude 4° 12’ to 53° 85’ South and longitude 35°
6° to 36°0’ East. The selection of Kondoa District for this study was mainly determined by the existence of exceptional land degradation and the existence of an elaborate soil conservation project in the name of Hifadhi Ardhi Dodoma (HADO).

Three villages were selected to accomplish data collection for this study objective. The selected villages were Haubi, Bolisa and Mondo (Figure 1). Spatial distribution and location of these villages in relation to KEA determined their selection. Bolisa village was selected because it is at the centre of KEA and close to Kondoa Town. Haubi village on the other hand was chosen because it is believed to be the cradle of the agro-pastoral Rangi ethnic community and it is within KEA. Finally, Mondo village was chosen because of being peripheral to HADO activities; half of the village land is within KEA and half of it is outside KEA. Figure 1 shows the location of these villages within and adjacent to KEA.

![Figure 1. Location of the study villages in Tanzania and Kondoa Eroded Area](image)

**Topography**

Generally, the geology of Kondoa Irangi hills is dominated by gneisses and other meta-sedimentary rocks of the late Archean. These rocks were folded forming a mountain chain during the Mozambican orogeny as continents were assembling forming the Gondwanaland super continent. By mid-cretaceous the mountains chains had been eroded down forming a peneplain surface presently
represented by the tops of Maasai inselbergs. By mid-tertiary the cretaceous surface had been eroded down to the present Maasai steppe surface. This means that the age of the planation surface is correlated to the planation surface of the Maasai steppe that dates to mid-miocene. Block faulting which probably started during Pliocene time resulted in uplifted blocks running north-south and tilted to the west (Shishira and Yanda, 2004).

**Rainfall**

The average rainfall for Kondoa District is 570mm, and about 85 percent of this falls in the months between December and April with a dry spell in February. During the onset of the wet season, rainfall is torrential resulting in flash floods. The rainfall patterns in the District are unevenly distributed and higher agriculture productivity is highly related to rainfall figures. Apart from the rainfall being relatively low, it is also unpredictable in frequency and amount.

**Agriculture**

Agriculture is the main activity carried out in the District. The proportion of suitable land for crop production in the District is about 66% of total arable land. About the total area of District i.e. 13,210 sq km, 1,362,648 hectares are suitable for agricultural production and about 398,637 hectares are used for crop production. About 95% of Kondoa people are farmers and livestock keepers; their farm size range between 5 and 10 acres average per household. The main food crops are maize, pearl millet, sorghum, beans and other food crops are cassava and sweet potatoes. Cash crops include sunflower, sim-sim, peanuts, pigeon peas, finger millet and currently the District is struggling to promote cashew nuts as a perennial cash crop.

**Livestock**

Livestock keeping is another main activity in the District, the livestock keepers own on average of 5 to 100 heads per household. The District has about 418,000 cattle, 394 improved breed cattle, 276,853 goats, 850 improved goats, 130,000 sheep, 19,400 donkeys, 2,000 pigs. All these animals are for income generation and food while other animals i.e. 4,000 dogs, 2,000 cats, and 81,000 rabbits are by and large pet animals. Most of livestock keepers use free range grazing system and indigenous breed is highly used that its production is low and with low quality. Few farmers practice zero grazing system.

2.2. **Data Collection Methods**

2.2.1. **Participant Observation**

Participant observation is a standard anthropological method that evolved as a means of understanding other cultures and how they relate to land use activities (Kikula, 1997). Participant observation with ethnography was used to understand and learn community perception, awareness of,
and concerns and attitudes on HADO activities. This involved taking part in evening talks with the people in the villages and making walk around the farms, households, degraded areas, and conserved areas together with villagers. In so doing, direct observation was made, asking questions and listening as the researcher lived with the local people. Data from this method were recorded using field notebooks, photographs and video clips.

2.2.2. In-depth Interviews to Key Informants

In-depth face-to-face interviews were conducted using unstructured interview schedules. In this method, sixteen (16) people where interviewed in Kondoa District, Dodoma Urban, Arusha Region, Dar es Salaam City and Ifakara – Kilombero District. The study used purposive sampling to identify key informants with the help of HADO officials. These people covered former HADO officials, outgoing HADO officials, District officials, researchers who work(ed) in the area, Ministry of Natural Resources and Tourism (MNRT) officials, Prime Ministers’ Office-Regional Authorities and Local Governments (PMO-RALG) (Environment and Natural Resources section) and HADO champions.

The aim of using in-depth face-to-face unstructured interviews was to collect in-depth information on the adoption of land conservation measures with the help of a checklist. Unstructured interviews made possible the acquisition of relevant information from people of different perspectives and experiences e.g. adoption of zero grazing. Further, five (5) telephone interviews were conducted with five people to seek explanation on issues which the researcher needed clarification.

2.2.3. Key Informants’ Interviews with Village Officials

Thirteen (13) officials were interviewed to collect information on factors for community adoption of land conservation measures. They included Kondoa District Council (KDC) officials (Village Chairpersons, Village Executive officers-VEO, Ward Executive Officers-WEO, Village extension officers, District Natural Resources Officer-DNRO and District Planning Officer-DPO). Further, these interviews gathered information on village initiatives that are in place to counteract land degradation activities.

2.2.4. Face-to-face Household Questionnaire Survey

In this study, a sample of eighty six [86] households for the face-to-face semi-structured household questionnaires was selected based on wealth ranking. Wealth ranking involved drawing respondents from three social classes (rich [juui], moderate rich [kati] and poor [duni]). A help of village register achieved this and later snowball sampling was employed to pick folded pieces of papers with numbers that were assigned to represent households in each sub-village.

A sample of two sub-villages from each village was selected (one being at the village centre, the second close to severely degraded area and the third sub-village with moderate land degradation) with
help from villagers. Six percent (6%) of households in each sub-village was drawn and used in the household survey. Selection of the sample size was based on homogeneity of socioeconomic activities, budget limitations and required level of results precision. This information collected from the household questionnaire sample was complemented by other information collected using other methods.

2.2.5. Documentary Review

A review of relevant documentary sources was carried throughout the study duration. Both published and unpublished sources were reviewed. They include books, dissertations, journals, research reports, government reports, memoirs, maps, photographs, audio and visual records.

2.2.6. Focus Group Discussions

In this study, five (5) focus group discussions were held in the study area. The composition of these groups included both men and women aged between 30 and 82 years. They were then further classified into wealth ranking groups i.e. rich, moderate and poor to allow the study gather information from different social classes.

3. Results and Discussion

3.1. Local People’s Perception of Land Degradation Measures

According to Mcdonagh and Semalulu (2014), land users’ perceptions of soil degradation are investigated within the overall context of their farming activities, that is, how significantly they rated soil as a factor affecting crop production against the background of other influences on their farming.

Because of land degradation and the move by the Government of Tanzania to initiate HADO project, several measures were laid down (Kikula et al., 1999; Ligonja and Shrestha, 2015). These measures geared at arresting continuation of land degradation in the study area. Among others, they included zero grazing, tree planting, terracing, contour bunds, and destocking of KEA (Mbegu and Mlenge, 1983). It was the interest of this study to investigate the state of this existence of land degradation measures in the study area. Findings in this study reflect that 78% of households interviewed suggest existence of one or more land degradation counteracts in the study area (Figure 2), whereas, 22% had a proposal that none of land degradation counteracts exist in the study area.
3.2. Existing Land Degradation Measures

After looking into community’s opinion on land degradation measures, the study went further to identify existing land degradation measures in the study area. Findings showed that 39.5% of households revealed tree planting to exist whereas 60.5% suggested tree planting do not exist (Figure 3). Also, study responses from households showed 60.5% suggesting contour and ridge making to exist while 39.5% revealed none existence of contour and ridge making in the study area (Figure 3). Another finding showed 53.8% of the households assert that zero grazing/stall feeding exists whereas 46.2% felt that zero grazing/stall feeding in the study area was insignificant (Figure 3). Wildemeersch et al., (2013) argued that although water and soil conservation (WSC) techniques are widely known, their implementation is site-specific and depends on local biophysical and socio-economic conditions.

The study by Ligonja and Shrestha (2015) in Kondoa had more similar findings that, soil erosion indicates positive change by overall decrease of very high soil erosion category (50–80Mg ha\(^{-1}\)y\(^{-1}\)), which declined by 5% of the study area throughout the study period. It occupied 30%, 26% and 25% of total land in KEA during 1973, 1986 and 2008, respectively because of enforcing land conservation measures.
3.3. Chi-Square Analysis on Adoption of Land Conservation Measures

Analysis of responses on adoption of land conservation measures was run using two sample case Chi-square. This analysis was done at 0.01 significance level with an assumption that most community members have not adopted land degradation counteracts.

**Observed Frequency**

<table>
<thead>
<tr>
<th></th>
<th>Tree planting</th>
<th>Contour &amp; ridge making</th>
<th>Zero grazing</th>
<th>Extension services</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adopted</td>
<td>24</td>
<td>38</td>
<td>22</td>
<td>0</td>
<td>84</td>
</tr>
<tr>
<td>Not adopted</td>
<td>40</td>
<td>32</td>
<td>34</td>
<td>0</td>
<td>106</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>70</td>
<td>56</td>
<td>0</td>
<td>190</td>
</tr>
</tbody>
</table>

**Expected Frequency**

Expected frequency = Column total * Row total divide by Grand total

Degree of freedom=Number of rows minus one times Number of columns minus one

\[ d = (o-e) \]

\[
\begin{align*}
(64*84/190) & \quad (70*84/190) & \quad (56*84/190) & \quad (0*84/190) & \quad 84 \\
(64*106/190) & \quad (70*106/190) & \quad (56*106/190) & \quad (0*106/190) & \quad 106 \\
64 & \quad 70 & \quad 56 & \quad 0 & \quad 190 \\
28.3 & \quad 31 & \quad 24.8 & \quad 0 & \quad 84 \\
35.7 & \quad 39.1 & \quad 31.2 & \quad 0 & \quad 106 \\
64 & \quad 70 & \quad 56 & \quad 0 & \quad 190
\end{align*}
\]
\[ x^2 = \sum \frac{d^2}{e} \]  
\[ x^2 = \frac{(24-28.3)^2}{28.3} + \frac{(38-31)^2}{31} + \frac{(22-24.8)^2}{24.8} + \frac{(0-0)^2}{0} + \frac{(40-35.7)^2}{35.7} + \frac{(32-39.1)^2}{39.1} + \frac{(34-31.2)^2}{31.2} + \frac{(0-0)^2}{0} \]
\[ x^2 = 0.7 + 1.6 + 0.3 + 0 + 0.5 + 1.3 + 0.3 + 0 = 4.7 \]
\[ df = (2-1) \times (4-1) = 1 \times 3 = 3 \]

The Null hypothesis (H_0) is accepted since the calculated value of \( x^2 \) (4.7) is smaller than the critical value (11.34) at 0.01 significance level.

3.3.1. Reasons for Adoption of Tree and Forest Planting

Adoption of innovations is an important part of any land conservation project. In HADO project, tree planting is considered as an achievement to be upheld. However, there are reasons behind such an achievement though now the trend of tree planting if compared to the rate of harvest does not convince future sustainability. As it was put by Tenge et al., (2007), farmers will only accept and adopt conservation techniques when they are solving a problem they perceive themselves and understand the necessity of conserving natural resources.

This study found that tree planting was adopted following the goods and services accruing from trees and forests. Response from households interviewed (Figure 4) showed these goods and services to include source of timber, fuel wood, fruits and shed (91%) and improved weather (9%). However, there are households that did not adopt tree planting in the study area. The reasons for non adoption of tree planting included non-availability of tree nurseries (50%), non-involvement in selling tree and forest products (16.6%), low purchasing power (16.6%) and free grazing (16.7%) (See Figure 4).

Figure 4. Reasons for Adoption and Non-adoption of Tree Planting
3.3.2. Reasons for Ridges Adoption

Adoption of contour and ridge making in the study area is revealed to soil and water protection measures (Plate 1). This is supported by 100% of all households interviewed in the study area (Figure 5). They emphasized that it would not be possible for a farmer to harvest high yields without contours and/or ridges in the farm. This is because ridges have not only reduced surface water runoff but also protected farms from soil erosion and sedimentation. The results are similar to the findings by Semgalawe (1998) who observed that perception and high ranking of erosion problems are among the factors that positively influence adoption of SWC in the northern mountains of Tanzania.

Nevertheless, adoption of contours and ridges has never been smooth. The reasons behind included high siltation in farms (25%), absence of technicians (25%) and non-involvement of the community in constructing terraces, contours and ridges (25%). Uncontrolled free grazing of livestock (25%) is another reason that hinders adoption of contours and ridges by farmers. There are cases where
livestock destroy these structures (See Figure 5). Thapa and Yila (2012) established that adoption of farmyard manure and mulching ranged from most popular to moderately popular because of the little technical skills and the realization of short-term benefits. The labour intensive nature of internal and external catchment may account for their low adoption.

According to Kajembe et al., (2005), the challenge in up-scaling use of internal and external catchment methods lie in their preparation because they are labour intensive and require technical skill. This may serve to discourage farmers. Adoption of these technologies further depends on articulation of economic incentives to farmers.

3.3.3. Reasons for Adoption of Zero Grazing

Zero grazing in the study area showed diversity in reasons for its adoption (Plate 2). Findings (Figure 6) depict that some households have adopted zero grazing for reasons that the KDC by-laws prohibiting free grazing are strict (57.1%). Other reasons include provision of manure (28.6%) and that it has reduced workload (14.3%). Whereas, reasons for non-adoption included increase in livestock population (40%), non-involvement of the community in zero grazing approach (20%) and impacts of drought in the study area (40%).

This challenge relates clearly to the practice of free grazing (Thapa and Yila, 2012) in most villages as livestock is allowed to graze freely on crop residues immediately after the harvesting season. A shortage in crop residues is sometimes exacerbated by prolonged dry seasons or frequent droughts,
which results in crop failure, hence limiting crop biomass production for subsequent use as mulch, fodder and fuel. Because of a shortage in residues, farmers generally prioritise feeding their livestock than leaving the residues for mulching (Ndah et al., 2015).

Plate 2. Zero Grazing at Haubi Village

4. Conclusion

This study was pursued within the context of project sustainability i.e. *Hifadhi Ardhi Dodoma* (HADO). To date, almost twenty years after SIDA withdrawal from funding HADO project, a few signs of successes remain. These signs ranged from adoption of tree planting, contour farming to zero grazing. However, adoption of these measures is not by many members of the community. Nevertheless, it signals positively that if an adequate approach is put in place e.g. conservation agriculture, more members of the community may adopt land conservation measures without great efforts from external project support.

Hence, the study recommends that Kondoa District Council together with lower level local government authorities (i.e. village governments) initiate measures that would gear at sustaining land conservation measures that proved successful in the area. This should be done through rectifying and filling in gaps that existed like involvement and participation of local communities in decision-making and enhancement and strengthening of extension services at village level.

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References


