Tanzania Journal of Forestry and Nature Conservation, Volume 79(2), 2009

AGRICULTURAL COMMERCIALISATION AND ITS IMPLICATIONS ON AGRO-DIVERSITY MANAGEMENT IN THE DRYLANDS OF CENTRAL TANZANIA

Liwenga, E.T., Kangalawe, R.Y.M., Masao, C.A.

Institute of Resource Assessment, University of Dar es Salaam,
P.O. Box 35097 Dar es Salaam-Tanzania.

Email: liwenga@ira.udsm.ac.tz

ABSTRACT

The study examines the linkages between agricultural commercialisation and agro-diversity management. It considers agricultural commercialisation an important socio-economic aspect with varied environmental implications, particularly in relation to agro-diversity management. The study was undertaken in Kondoa and Kongwa Districts, in the semiarid central Tanzania. The aim of this study was to examine the implications of agricultural commercialization on agro-diversity management, food security and the environment in general. A variety of methods were used in the study including participatory assessments techniques, field visits and household surveys. Household data was analysed using SPSS. The findings from this study indicate that for decades agricultural production in the semiarid areas of central Tanzania has been centred on production of a diverse number of crops though concentrated on sorghum and millets as the most drought tolerant grain crops. However, from the mid-1980s the balance has shifted in favour of cereal crops like maize, which has become among the major cash-earning crop. Other prominent commercial crops included pigeon peas, sunflower and simsim. Commercial crops appear to be expanding at the expense of traditional drought tolerant crops such as bulrush millet and sorghum, thereby influencing the local agro-diversity. The abandonment of some crops e.g. castor oil plants in favour of market crops also appear to affect the agro-biodiversity in the study areas. It has been found that expansion of farms is a major factor for environmental degradation through deforestation, declining soil fertility due to continuous cultivation and emergence of noxious weeds such as Striga. On the other hand agricultural commercialization appears to have been associated with improvement in food security, household income, housing conditions and education for children. However the emphasis of the less drought tolerant crops like maize in these semiarid areas makes the sustainability of the agricultural system very uncertain

Keywords: Agricultural commercialisation, agrodiversity, food security, semiarid Tanzania

INTRODUCTION

The present situation of the farming systems in the East African drylands is a complex one. The challenge facing farming communities in these areas as related to agro-diversity management is a result of a combination of factors that have their roots in the socio-economic, policy and ecological factors. Though the drylands represent a major part of East Africa, their economic significance and sustainability is debatable. One major feature of the production systems in these areas is the emergence of certain trends e.g. commercialisation of the agricultural sector. The paper discusses the implications of commercialisation of agricultural production as one of the current trends in the dryland areas. It focuses on the

dynamics in farming systems and agro-diversity as influenced by commercialisation of agricultural production and the socio-economic and environmental implications of such changes. The paper further addresses the opportunities and challenges associated with agro-diversity management in the drylands of central Tanzania.

There are different opinions with regard to the extent of integration of peasants into the world market economy and the overall implications and the environment. Ellis (1993: 3) considers that peasants are neither fully integrated into the economy nor wholly insulated from its pressures, as they have a foot in the market and the other in the subsistence economy. Where market forces have worked against subsistence needs, rural producers have withdrawn from market (Hyden, 1980; Smith, 1989). Others view the commercialisation of traditional economies as involving a breakdown of local subsistence production and the creation of farmers' dependence on cash income from crop sales (Dixon, 1990: 38). This process is often associated with disruption of traditional farming techniques. This subsequently results in neglect of indigenous knowledge and resource management systems, which were, for generations, environmentally friendly (cf. Lyimo and Kangalawe, 1997). Also increased dependency on external markets implies greater loss of control over resources by local agricultural producers (Igbozurike, 1976: 35). The inferior position of peasants and subsequent subordination to external control through the market can have considerable repercussions on food security and local resource management.

The integration of rural producers to the world economy is an important element in understanding the impacts of changes in agricultural marketing on farming systems, food security and local resource management. The process of integration of peasant producers into the world economy, often called "commoditisation of traditional economies" (Havnevik, 1993; Wiggins, 1995), has partly been achieved through introduction of the monetary economy, cash crop production and taxation by both colonial and post-colonial governments. Farmers have therefore increasingly become dependent on the market. There exist various arguments in relation to the extent of integration of peasants into the world market economy and the overall implications to their livelihoods. This paper also tries to provide an understanding of agricultural changes in the drylands of developing countries through analysis of the integration of smallholder producers to the world market economy.

RESEARCH METHODOLOGY

The Research Design and Approaches

The study was conducted in the semiarid areas of central Tanzania, with case studies in selected villages in Kondoa and Kongwa Districts, currently famous in commercial maize production. Four villages were selected for this study; and these are Kwadelo and Jangalo in Kondoa District and Hembahemba and Ngomai in Kongwa District. Kwadelo and Jangalo Villages are located in the eastern part of Kondoa District in the Masai plains commonly known as the Lower Irangi. Administratively Kwadelo village is located in Kwadelo Ward which in Pahi Division, while Jangalo is in Jangalo Ward in Mondo Division. The villages are located about 70km and 90km from Kondoa District Headquarters respectively. Hembahemba and Ngomai villages are located in Kongwa District, also in the Masai plains, about 40km and north-east of district headquarters and approximately 15km and 10km (respectively) from Kibaigwa Maize International Market. Both Hembahemba

and Ngomai villages are located in Njoge Ward in Mlali Division.

The methods of data collection in this study ranged from literature search, participatory assessments (PRA) as described by Chambers (1992) and Mikkelsen (1995), field observations and interviews. Semi-structured interviews were undertaken with villagers through group discussions and other key informants, whereas structured interviews were carried out at household level with villagers the study area. In each study village, a sample of 5% of households was selected for conducting structure household questionnaire. The issues covered during these interviews included: basic household data, household responses in relation to commercialisation of agricultural production in terms of crop types and varieties used; associated changes in farming practices; and constraints and opportunities as related to food security. Data from household interviews were analyzed using the SPSS (Statistical package for Social Science) computer Package. Table 1 presents the villages, households and sample sizes.

RESULTS AND DISCUSSION

Population Trends

The study findings show that human population in the studied villages has been increasing over time. The population has been increasing due to both natural increase and in-migration. Such increase may imply increased pressure on available resources. From Figure 1 it appears that migration took various patterns. Most people migrated into the study area around the mid-1970s, 1980s and between 1990s to-date.

Based on discussions with villagers it appears that there are several explanations for the observed patterns. Interviews with key informants indicated that before the 1970s in-migration of farmers into the study villages in Kongwa district was prompted by the declining productivity of maize in the Isimani area in the neighbouring Iringa Region. Isimani area was among the most productive and popular places especially for production of maize. This situation explains the current patterns of ethnic composition of the studied villages where about 20% of farmers interviewed in Hembahemba and Ngomai villages are Bena and Hehe from Iringa.

Around mid-1970, the movements were associated with villagization program. Trade liberalization and the establishment of the International Maize Market at Kibaigwa in the early 1990s could be associated with the migration patterns observed from the mid-1980s todate. The majority of the respondents (82%) reported that they migrated into the current villages in search for agricultural land. Other reasons for migration into the study villages included looking for business opportunities e.g. marketing of agricultural products, following relatives, marriage i.e. following spouses, employment in the case of civil servants. Other people moved in as casual labourers from various parts of Dodoma Region such as Mvumi (Liwenga, 2003). However, the recent pattern shows a declining trend in the number of people migrating into the study villages. The decline could probably be due to the fact that currently there is less possibility of getting land for agricultural expansion within the studied villages, particularly in Kongwa district.

Major Economic Activities

From discussions with villagers in both Kwadelo and Jangalo villages in Kondoa, it was established that the major economic activities undertaken include agriculture, which is mainly undertaken by the Rangi, the Gogo and the Iraqw, livestock keeping practiced mainly by the Barbaig and the

Masai. In addition to farming, the Rangi, the Gogo and Iraqw people also undertake livestock keeping. Other livelihood activities include petty business which includes kiosks, shops, food vending selling local brew, making and selling charcoal, brick making, carpentry, masonry and beekeeping. Some few people are employed in the various service sectors including health and education. These activities are similarly undertaken in Hembahemba and Ngomai villages in Kongwa district. In addition, Ngomai villagers used to practice honey harvesting within the village and its surrounding. This activity made cultivation to involve small sizes of farmlands as people had other livelihood alternatives. The discussions indicated that honey harvesting was possible due to the fact that the area had enough forests, which are now deforested.

Agricultural Commercialisation in the Study Villages

Trends in Agricultural Commercialization

Various crops were reported to be grown in the study villages, some of which are traditional while others are newly introduced crops. The traditional food crops include bulrush millet, sorghum - (the white sorghum locally known as *Rangaranga/Lugugu*) and Serena (the red sorghum, locally known as *Udo*), and bambara nuts. Traditionally, finger millet and castor oil plants were regarded as the main cash crops in villages studied in both Kondoa District and Kongwa District. Over time, other crops have been introduced in these areas, including maize, groundnuts, cassava and sweet potatoes as food crops. The newly introduced cash crops included pigeon peas, sunflower, simsim, cowpeas and green grams.

It should be noted however that despite the distinction between food and cash crops, all food crops could sometimes during the year be sold where a household is in urgent need of cash. This was reported to be most commonly done in April, just before the next harvest. It has also been observed that the production of many crops in the study areas is gendered in nature. Crops such as bambara nuts and lablab are mostly produced and controlled by women, and are mainly used for food, and are not generally regarded as crops for the market.

Findings from this study revealed that agricultural commercialisation has been associated with a decline in the production of some types of crops. It was reported that crops like castor oil plants, sorghum (*Udo/serena* – the red variety), and finger millet have declined, respectively due to lack of market and shift from eating finger millet-based meal to maize meal. Currently castor oil plants is not grown at commercial scale in al the studied villages.

Instead other crops with more ready markets and/or more favourable market prices are grown for commercial purposes. In Jangalo for instance, simsim was reported to have been introduced in the village only recently, in the year 2000, and farmers learnt about this crop from travelling to other places where the crop has been commonly grown.

This study also found that in both Kondoa and Kongwa Districts agricultural commercialization has been associated with change in crop varieties. Generally there has been a substantial decline in production of traditional varieties of most crops. Where the traditional crop varieties are still being grown in the study villages, they are particularly being grown by elderly people due to some positive attributes associated with those varieties. For instance, it was reported in Jangalo and Kwadelo villages that the traditional varieties of maize (e.g. *Bunzi jekundu* and *laini nane*) and bulrush millet (e.g. *Italala*) are considered to be more drought tolerant, have longer storage life without the need to use of storage

pesticides. The traditional bulrush millet variety was also reported to be less susceptible to bird damage by birds such as *Quelea quelea*. A change of taste for some traditional crops especially among the youth has made them to switch to the more market oriented crops (cf. Kangalawe, 2001).

Table 1: Number of Households and Sample Sizes in the Study Villages

Village Name	District	Number of Households	Sample size
Kwadelo	Kondoa	720	36
Jangalo	Kondoa	870	44
Hembahemba	Kongwa	500	25
Ngomai	Kongwa	1670	84
TOTAL		**3760**	**189**

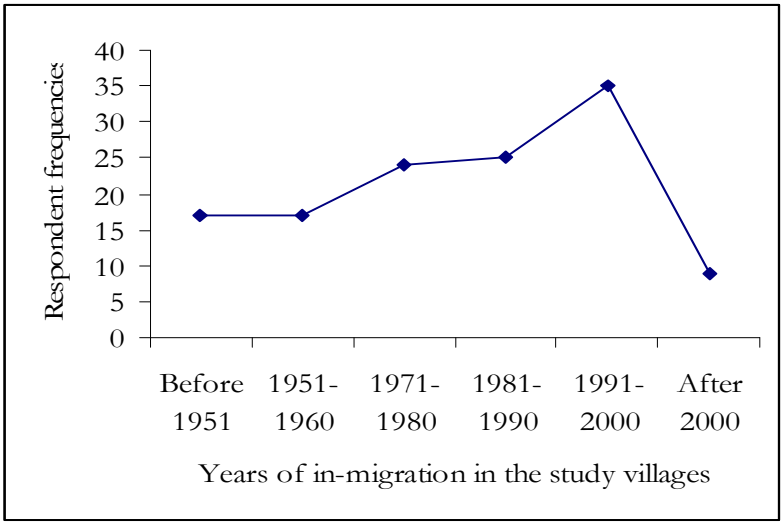

Figure 1: The periods for significant in-migration in the study villages

Farmers reported during the PRAs that cropping patterns have been towards new crops or crop varieties used. For example, from the long maturing traditional varieties to short maturing new varieties; and from the low yielding traditional varieties to more high yielding new varieties. Similar change patterns were reported in villages in Kongwa district. However, farmers in Hembahemba and Ngomai villages were concerned that while the traditional crops were more adapted to the harsh weather conditions of the area, some of the new varieties are not well adapted. Growing such new varieties therefore could jeopardise food security especially in case of unfavourable weather. Similarly there was a concern that most of the new varieties are vulnerable to pest and diseases unlike the traditional seeds that are well adapted to the local environments.

Furthermore there have been considerable changes in the intensity at which some crops are produced. Some of the traditional crops like sunflower and pigeon peas were reported to be currently grown at

commercial scale unlike in the past when they were predominantly produced for home consumption. Even the newly introduced crops are also grown at much larger scale compared to the past few decades. The intensity of cultivation of some crops is reflected in the changes of the acreage over time. Results from household surveys indicate, for instance, that before 1990 only about 17.5% of the respondent farmers had maize fields of more than 20 acres (8ha). The remaining 83.5% had maize fields smaller than 8ha. Currently about 24% of the respondents have maize fields bigger than 20 acres (8ha), ranging from 20 - 300 acres (8-120ha). Similar patterns were also observed in other commercial crops such as pigeon peas (whose acreage has increased from 0.4-12ha before the 1990s to 0.4-20ha per household at present) and simsim. Before the 1990s agricultural production in the study areas was largely on subsistence basis, but turned into commercialised production thereafter. The acreage for other crops is generally small, ranging from 0.4-7ha per household.

Regarding the levels of crop production, a large proportion of interviewed farmers were concerned that the productivity has generally been declining over years (Table 2), especially so in more commercialised Jangalo, Hembahemba and Ngomai villages. Several explanations were given regarding the declining production. First, there was a concern that generally the amount of rainfall has decreased during the last ten years, with longer dry seasons and shorter growing seasons. This was expressed by 66% of respondents. This could be attributed to global changes issues that generally indicate that the climate is changing. The second explanation is crop damage by either insect pests or wild animals, as expressed by 29% of the interviewed farmers. This was a particular concern among farmers with distant crop fields located in the expansion areas, close to Manyara region. The argument was that because they stay far from their fields they do not have sufficient time for either scaring away wild animals or spraying against insect pests. The third explanation was that the land is constantly under cultivation, resulting to a decline in soil fertility, hence leading to low crop productivity. Although this concern was raised by only 9% of respondents, it could be a common experience to most farmers especially the resource poor households who are not able to acquire new land in the expansion areas. As such they have to rely on their exhausted old farms within the village premises.

Table 2: Percentage responses on the status of crop production during the last ten years

Production Status	Village				Total
	Kwadelo	Jangalo	Hembahemba	Ngomai	
Increasing	8.3	13.6	8.0	7.1	9.0
Decreasing	41.7	61.4	84.0	72.6	65.6
No change	11.1	9.1	0	4.8	6.3
Fluctuates	38.9	13.6	8.0	13.1	17.5
Do not know	0	2.3	0	2.4	1.6
Total	100	100	100	100	100

About 17.5% of the interviewed farmer seemed to experience fluctuations in production. This could be explained by fluctuations of rainfall conditions in the different growing seasons, with higher production being attained in seasons with

good rains, and vice versa for bad ones. However, there are those farmers who still report that crop production is increasing. This could be the richer farmers who have access to new and fertile lands in the expansion areas, and those who have access to the modern farm tools like ox-ploughs and tractors. As such they are able to increase production by ensuring timely performance of farm activities to time the rainy season and by cultivating larger fields.

Factors for Change in Types of Crops

Changes in types of crops produced in the area have been gradual, and have been influenced by various prevailing conditions. It was argued during participatory assessments that, during the colonial era, the colonial government introduced crops such as maize, beans and groundnuts. In Jangalo, for example, maize and beans were reported to have been introduced in the early 1930s. After independence, there was emphasis by government to grow drought tolerant crops such as cassava and sweet potatoes.

Further, in the 1970s, following Villagisation policy implementation, more crops were introduced due to increased interaction with people of different cultures who were brought together. According to the villagers in the study area, some crops became prominent during this period; including maize and sunflower.

It was further reported that, the establishment of Cooperative Unions in the 1960s to 1980s further promoted the production of maize and sunflower for marketing. In the 1980s and 1990s, the establishment of oil industries in Arusha and Kilimanjaro Regions motivated production of crops such as sunflower and simsim. Examples of such industries include Mt. Meru Company and Sunola, which produces Cooking Oil from sunflower, simsim and other edible oil seeds. Other crops such as pigeon peas and green grams started to be produced in the study areas due to growing needs in various places in the country, particularly big towns like Dar es Salaam, Arusha, Moshi and Dodoma towns where they are used in confectionery industries. While Cooperative Unions promoted the production of some crops, failures of these unions in some parts led to the decline in the production of other crops such as castor oil plants. The decline of castor oil plant production was associated with a fall of its market. However, there are some few people especially elders who grow a few plants for medicinal purposes.

The drop in production of sorghum (*Udo/serena and rangaranga*) and bulrush millet in the studied villages was reported by the farmers to have largely been associated with a change in preference of local brew and staple food. Villagers reported that currently, they prefer for local brew made by *Choya* flowers instead of sorghum; they also prefer stiff porridge made of maize meal instead of sorghum or bulrush millet. The decrease in finger millet was associated with increased production of this crop in more potential parts of the country (e.g. the southern highlands) thereby creating competition for market. The high production cost of some crops/varieties was also reported to be another factor for the decline in their production (e.g. finger millet). Likewise the labour intensive crops seemed less motivating among some farmers.

Among the factors to the change of crop varieties is the time to maturity. Short maturing varieties were reported to be more preferred because of the unreliable short duration rainfall characteristic of the area. The other factor is the commercial value of different crops or crop varieties. Crops and/or crop varieties considered to be of high commercial value are currently being grown to a larger scale compared to those perceived to be of low commercial value.

This has been one of the reasons for the recent introduction of cash crops like simsim.

Another factor for change is accessibility to the markets. Crop that fetches ready markets are currently more preferred. For example, in the 1980s and 1990s, more crops were introduced in the study villages including sunflowers, finger millet and pigeon peas. Unlike maize, which has a market in close vicinity, it appeared that crops like sunflowers, finger millet and pigeon peas depend on external markets such as Arusha, Dar es Salaam, Morogoro and Kilimanjaro. This means more transportation costs to the markets. During the same period there was more emphasis to drought tolerant crops such as cassava and sorghum due to increase in years with long dry seasons. However, the establishment of the International Maize Market in Kibaigwa was reported to have caused people to concentrate more in maize production instead of the drought tolerant crops. This may have a negative implication on the food security situation and agro-diversity of the area.

Agricultural Commercialization and Farming Practices

The survey has revealed that there have been changes in farming practices and cropping patterns in the studied villages mainly attributable to ongoing agricultural commercialisation. Traditionally, villagers used to grow mixtures of about three to five different crops in one field. The mixture could include maize, cowpeas, beans, sorghum, pumpkins, and watermelons. Currently, the cropping patterns were reported to comprise a mixture of fewer crops i.e. between two and three; for example maize is mixed with pigeon peas or beans. However in villages like Ngomai some farmers grow crops in pure stands, for example maize farms, especially for people who cultivate large farms using tractors.

The current cropping patterns involve production of bulrush millet and sorghum (white variety – *Rangaranga*) in the fields closed to homesteads so as to facilitate bird scaring to minimise crop damage. In Kwadelo Village, for instance, it was reported that, crops such as groundnuts and cowpeas are also produced in the homestead fields to ensure easy accessibility, harvesting and collection of various farm products (e.g. vegetables). The growing of maize and other commercial crops such pigeon peas and sunflower is mostly confined to the expansion/distant areas. In Kwadelo village, the expansion areas include locations like Mbowi, Miwu, Kisai, Idali, Naivasha, and Machakos in the eastern side of the village (some outside the village borders). According to villagers, these expansion areas are regarded to still have good vegetation cover and good soils. The implication of this is that clearance of vegetation cover continues to expand outside the village centre. For Jangalo village the crop fields were reported to also expand beyond the village borders, in places like Mlonga, Itolwa, and Kwakutwa. For villages in Kongwa district (Hembahemba and Ngomai) crop fields are being expanded beyond the village, district and regional borders and as far as Kiteto district in Manyara region. The growing of maize as a commercial crop therefore appears mostly confined to the expansion areas. However, it was asserted that such expansion has not been accompanied by improved extension services. The expansion was associated with occurrences of resource use conflicts. In some places it has involved turning the grazing lands into farmlands.

In line with changes in cropping patterns, there are also changes in the technologies used in agricultural production. Farmers in these villages have started using new technologies in crop cultivation, such as the use of tractors and animals power in addition to the hand-hoe. They argued that

the main factor for change in technology is the expansion of maize production. The new technologies involve the use of ox-ploughs and tractors. However, more people were reported to be using more ox-ploughs in cultivation than tractors. The main explanation for such observations was reported to be due to limited availability of these implements. Furthermore, the farmers indicated that most people could not afford to hire or buy these implements. Furthermore, there are significant variations on the use of these technologies between the two districts. In villages in Kondoa district for instance, majority of people (75%) reported to use the hand hoe for various farm operations. Only about 10% reported to use ox-drawn implements like ox-ploughs, while the remaining 15% reported to use tractors. On the other hand, a majority (70%) of people in villagers in Kongwa district use tractors for various farm operations. About 20% reported to use ox-drawn implements like ox-ploughs, while the remaining 10% reported to use hand tool (the hoe). These variations are largely attributed to the levels of agricultural commercialisation, with Kongwa being more commercialised as a result of its close vicinity to the Kibaigwa International Maize Market.

In all the studied villages, it was reported that the number and size of farms cultivated by individual households has expanded from the traditional two acres (0.8ha) in the past to between 20-40ha per household at present. The observed expansion of farm has increased the demand for labour, and family labour is no longer sufficient in almost all villages studied, particularly in the highly commercialised Hembahemba and Ngomai villages. As such there has been increasing reliance on casual labour, which has attracted people, especially youth from various parts of Dodoma region. The other alternative to family labour is the use of working parties. The latter was however reported to be on the decline because very few have the patience to wait for the turn when work could be done in their household farms. The fear for "missing the season" is the key factor for the use of other forms of labour instead of working parties.

Implications of Agricultural Commercialization

The study findings indicate that agricultural commercialization has been associated with various agricultural, socio-economic and environmental implications. These implications are discussed in the following sections.

Agricultural Related Changes

Findings from the study indicate that there have been changes in types of crops produced over time in the study villages. These changes appear to be brought about by a number of factors, the main one being market orientation. Other factors include changes in weather conditions which have implied increase in years of drought which is associated with increase in production of cassava in some of the studied villages. Changes in types of crops produced have also been associated with changes in crop varieties depending on the yield characteristics and period to maturity. Most of the changes associated with agricultural commercialisation appear to have started from the mid-1980s. The market oriented crops include maize as the most prominent cereal crop. The commercial oil crops include sunflower and simsim, whereas the leguminous ones include pigeon peas.

Crops such as sorghum, bulrush millet, and cassava are grown largely for food, while maize apart from being a food crop is also used as a cash crop. Production of maize was reported to have become more prominent due to trade liberalization and the establishment of the International Maize Market at Kibaigwa located in Kongwa District. Discussions with officials at

Kibaigwa market indicated that the market was officially established in 1992 to facilitate maize marketing. However, even before its establishment the marketing of maize was taking place and the area was regarded as a collection point for maize before it was sent to Dar es Salaam (in Tandale market). The market caters for farmers in several regions including Dodoma, Manyara (Simanjiro & Kiteto), Tanga (Handeni), Morogoro (Kilosa & Mvomero), Iringa (Kilolo), Singida (Manyoni) and Shinyanga (Bukombe). Maize from this market is also exported to the neighbouring countries, particularly Kenya and Malawi. Further discussions with villagers from Kondoa District justified the influence of the Kibaigwa market in their agricultural production activities. The expansion of maize production appears to be at the expense of the traditional drought tolerant crops such as sorghum and bulrush millet. This negates the first hypothesis of the study that "Agricultural commercialisation has not had negative impact on the agro-diversity of the drylands of central Tanzania particularly through the shift to crops less adapted to dryland conditions".

Structural changes in prices and marketing system in 1970s forced oil seed crops production (groundnuts, sunflower, simsim and castor oil plants) to decline. Currently the cash crops of some importance in the studied villages are maize, sunflower and simsim. From discussions with villagers in the study area, it was further learnt that, the increase in production of oil crops such as sunflower was associated with establishment of processing industries for cooking oil within Dodoma Region and in the nearby Regions such as Arusha. This was reported to have enhanced the marketability of the oil crops and therefore dependence on these crops as sources of income. Castor oil, which used to be a cash crop in the past appear to have been abandoned due to problems with marketing of the crop. This confirms that the agricultural marketing conditions appear to play a significant role in the types of crops produced.

The findings from this study further give an indication that agricultural commercialization has been associated with changes in farming practices. There has been a tendency towards agricultural mechanization by the use of animal power and tractors in cultivation, which is mainly associated with expansion of farm sizes. Agro mechanization appeared to be more prominent in Kongwa District, possibly due to their closer access to the Kibaigwa International maize market. Apparently the use of agricultural inputs such as fertilizers was reported to be still low. Farm yard manure is normally applied in the homestead fields, which show signs of exhaustion of soil fertility due to continuous cultivation.

It was further learnt that the current cropping patterns involve fewer intercropped crops e.g. 2-3 compared to the past whereby 3-5 where were intercropped. The current mechanisation patterns seem to limit high level of intercropping (cf. Ruthenberg, 1980). The current growing patterns involve growing of food crops in the nearby plots and commercial crops in the distant fields, also associated with less focus on traditional crops/crop varieties and patterns. Similar observations were reported by Dixon (1990), who argued that integration of peasants in market economy is associated with disruption of traditional farming techniques resulting in neglect of indigenous knowledge and resource management systems. Cultivation of cash crops only in the homestead fields, which are generally small, may have some implications on food security because of their limited productivity. Another change in farming practices reported was a move from shifting cultivation to sedentary cultivation.

In the long run this is likely to further lead to exhaustion of soil fertility.

Socio-economic Implications

With regard to socio-economic aspects, the findings indicate that the villagers in the study villages are differentiated mainly based on wealth characteristics of the household. Most of the well-off groups were reported to cultivate distant fields concentrating on production of commercial crops, whereas the poor cultivated the homestead fields with more focus on food crops. Households in the middle group were reported to be cultivating both the homestead and distant fields and reported to grow a great diversity of crops. Further discussions with villagers revealed that the poor households were the main source of labour to the rich households. As such the poor households have little time to work in their own plots, a situation that makes the poor households to experience frequent food shortages. Despite these differences it was generally acknowledged that agricultural commercialization has had positive implications through improvement of livelihood of people in the study area. The improvement has been related to food security and household incomes. However, those who benefit most are the wealthier groups because they are more able to capture the advantage of economies of scale having bigger fields. Studies in other parts of the world have shown that availability of agricultural markets is directly linked to food security, poverty issues and ultimately land management aspects. Thus, efficient agricultural market is essential for agricultural intensification (Mortimore, 1993). Improved marketing services are considered to often enhance the economic capability of the farmers, thus enabling them to invest resources on land management, overcome food insecurity and alleviate poverty. Understanding relationships between changes in agricultural marketing, land management and food security is vital for sustainable development.

Agricultural commercialisation seems to provide both opportunities and pressures to farmers (Ellis, 1993). For example, while agricultural commercialisation in the study area has contributed to improving community livelihoods, it has also been a cause for increased in land use conflicts in some of the studied villages. Household interviews further indicated that land use conflicts are more pronounced in Hembahemba and Ngomai villages, located in Kongwa district. The most common land use disputes were between farmers and livestock keepers. Similar observations regarding type of land use conflicts were recorded in villages in Kondoa district. While farmers needed land for their crops, the livestock keepers needed it for pastures for their animals. Increased population, with subsequent pressure on the land resources, appears to have played a big role on land use conflicts. Farmers/livestock keepers' land use conflicts were reported to be experienced for both homestead and distant fields. Land use disputes mainly occur during the rainy season whereby villagers tend to cultivate any piece of land, which is available. In Ngomai for example, it was reported that farmers cultivate up to the livestock bomas, within cattle routes, near the watering points and the grazing lands such that livestock keepers become squeezed.

Implication of Agricultural Commercialization on Biodiversity Management

Agricultural commercialization appears to have diverse negative implications in the dryland environment. Such impacts include effects on soil fertility, weeds, crop disease, crop pests, deforestation and biodiversity loss. The increased incidences of crop pests and diseases in the studied villages may be explained by the increasing tendency

towards monoculture and much less crop diversity. In addition, since new crops have been introduced into these villages in the past few decades, it can be possibly be hypothesised that the brought in seeds brought with them diseases organisms. The other hypothesis would be that the newly introduced crops are less adapted to the local environments hence succumb to native pests and diseases compared to the traditional crops. Among the key environmental problems were explained as follows:

Weeds

It was reported by the respondents during household interviews that, there is a dramatic increase of weeds in the study villages. This was a concern of 62% of the respondents. Villagers complained that weed infestation has been increasing with time. Most weed problems were reported to be experienced especially when weeding is delayed. From the group dynamics during the participatory assessments, participants appeared to be very concerned while discussing issue of weeds. Other weeds, such as *Striga sp*. were reported to have also appeared in recent years especially for villages in Kongwa District.

Insect Pests

Insect pests were reported to be an important problem that influences agricultural production under commercialisation. Majority of the respondents (75%) during household interviews indicated that the incidence of some traditional pests has increased to a large extent while new ones have also been encountered in the recent years. Some of the mentioned pests included: Larger Grain Borer *(Prostephanus truncatus*) or *Dumuzi* in Swahili; and Stink bug (*Nezara viridulla*) or *Panzi kunuka* in local name (the two pests were reported to be new to the area). Other pests/vermins included wild pigs, stem borers and Armyworms (*Spodoptera exempta*) or *Viwavi jeshi* in Swahili (locally known as *vigoda*). The latter were reported to be common pests/vermin in the area, but incidences or severity has increased to a large extent in recent years. Other insect pests are stem borers – *Buseola fusca* (locally known as *Sulenge*).

Diseases

It was established during PRA sessions that crop diseases are among the major threats to crop and livestock production. Likewise, observations from the household interviews indicated that a considerable proportion (41%) of farmers is concerned about increase in crop diseases. One of these diseases is die-back of the maize plants (locally known as *Ntotaa* in Rangi) was one disease (as mentioned during in Jangalo). Some of the diseases were reported to be caused by insect pests, like stem borers. Maize rust *(*locally known as *Ukungu*) was one diseases mentioned to cause low productivity in maize, often causing scorching of the maize plants.

CONCLUSION

The finding from this study indicates that agricultural commercialization has both positive and negative implications on socio-economic development and the environment in general. The study findings further indicate that there have been changes in types of crops produced over time over the study areas, with tendency towards reduced crop diversification, hence less agro-diversity. These changes appear to have been brought about by a number of factors the main factor being market orientation in favour of few commercial crops. Most of the changes associated with agricultural commercialisation appear to have occurred starting from the mid-1980s. The market oriented crops include maize as the most prominent cereal crop. The commercial oil crops include sunflower and simsim, whereas the leguminous ones include pigeon

peas. Apparently, agricultural commercialisation in the studied villages appears to be associated with land use disputes. This problem, however, calls for more interventions related to land use planning.

The fact that the study areas are located in the semiarid environment implies that if appropriate measures are not taken there is possibility that the area could be prone to food insecurity in case of unfavourable and unforeseen climatic variations. This is based on the fact that agricultural commercialization in the study areas appears to favour production of single or few commercial crops, most of which are not suitable to semiarid conditions. The implication is that farmers need to be guided in the process so that they could benefit more from agricultural commercialisation. This can be done through appropriate extension services taking into consideration the existing agro-ecological limitations so as to sustain their efforts in aspects such as crop diversification. Farmers should further be guided such that they make use of their indigenous knowledge by protecting their traditional farming technologies and crops such as bulrush millet and sorghum that are suited to these areas but currently becoming unpopular.

This study focused on agricultural commercialization in drylands, thus conclusions may be limited to such agro-ecological conditions. Further research would thus be needed in other agro-ecological zones of the country to examine the patterns of agricultural commercialization and implications to the socio-economic development and the environment, especially taking into account of the current trends in climatic changes/variation.

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