

Linking perceived land and water resources degradation, scarcity and livelihood conflicts in southwestern Tanzania: implications for sustainable rural livelihood

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Abstract In Africa, the land and water resources quality are key factors for sustainable development. The degradation of the quality of these resources leads to scarcities and conflicts, which together threaten the sustainability of rural livelihoods. This work investigated and analysed the livelihoods conflicts over the land and water resources and their scarcities, policies that contributed to the land and water scarcities and the livelihood conflicts and linkage of the conflicts to the resources scarcities and degradation. Implications of degradation of the resources, development policies and livelihoods conflicts on sustainable development are discussed. Literature study, visits and discussions, participatory assessments, observations and questionnaire survey were used tools to collect data. Interviews of the 266 households revealed that, those experiencing the land and water scarcities and conflicts over these resources are significantly ($p < 0.001$) higher than those not experiencing the scarcities and conflicts. Crop-livestock competition, over the land and water resources causes prominent conflicts. A significant, ($p < 0.05$) associations of livelihoods conflicts to water shortage and period of water shortage for crop and livestock production were found. Improved accessibility to soil and water management technologies, wildlife–livestock co-existence, recognition of needs and land rights for pastoralists are recommended to minimize scarcities and herders versus farmers' conflicts.

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1 Introduction

The scarcity of the land and water resources threatens human security, which lead to conflicts everywhere in the world. The United Nations Development Program (UNDP), in its human development report (1994) defined human security as: “safety from such chronic threats as hunger, diseases and repressions, protection from sudden and hurtful disruptions in the patterns of daily life”. The livelihood security threats that may result from the scarcity of the land and water are diseases, hunger, unemployment, social conflicts and environmental insecurity. The extent and nature of the livelihoods conflicts over scarce land and water resources do vary from one place to another. The extent of conflicts may vary from confusion and frustration among members of the community over poorly communicated development policies (Kant and Cooke, 1999) to the violent clashes between livelihood groups. The nature of conflicts can vary from ownership disputes between or among the livelihood groups or classes, to competition for access to use of resources for the livelihood activities. The Environment Development Challenges (EDC) News (2001a) reported that, violent clashes occurred between sedentary agriculturalists and nomadic pastoralists, because of the adaptive ways used for livelihoods in times of the land and water shortages. According to the UNU/IAS (2004) shortage of good land, fertile soil and moisture supply may undermine productivity of rural people; threaten livelihoods, which lead to social conflicts. The land and water resources are subject to increasing scarcity as a result of environmental change, increasing demand, and their unequal distribution (Homer-Dixon and Blitt, 1998). Environmental change, which induces scarcity, may include the land and water degradation, extensive land clearing and climatic change. Increasing demand can be created by the rural demographic growth, rural enterprise development and the land use changes.

In Africa, the development policies contribute to the problem of agriculturalists and pastoralists livelihoods conflicts over the land and water resources. Examples are policies, that confine the pastoral production activities into degraded lands (Pieri and Steiner, 1997); that favour farming activities irrespective of needs and rights of the pastoralists to livelihoods assets (Farouk, 2003; Susan, 1996; Tonah, 2002); alienation of land for commercial interests (Lane, 1990). Kajembe, Mbwilo, Kidunda, and Nduwamungu (2003) observed that, the land policies and legislation in Tanzania have resulted into virtual exclusion of pastoralists and agro-pastoralists' rights to grazing lands and water rights. This exclusion contributed to the livelihoods conflicts between herders and crop growers in various places in Tanzania. The media often reported herder versus farmer conflicts in Tanzania, for example in Rukwa valley (Brockington, 2000), in Kilosa, Morogoro region (EDC News, 2001b), in the Usangu plain (Lukumbo, 1998 in Development Education Global News; and Mpinga, in the East African of July, 7–13, 1999). Apart from the widespread reporting by the media of the clashes between herders and farmers, there have been little efforts to understand the extent, nature and reasons of these rural livelihoods conflicts. Little is known, on the linkage between resources degradation, shortage and the livelihoods conflicts in the Usangu plain, SW Tanzania. Do development

policies contribute to resources shortage, and thus livelihood conflicts in the Usangu plain? This work was undertaken in the Usangu plain, Mbarali District, in south-western (SW) Tanzania to investigate and analyze: scarcity of the land and water resources for rural livelihoods, conflicts over the land and water resources and the development policies and how do they contributed to the land and water scarcities and livelihoods conflicts. In addition, the paper discusses interactions, linkages and implications for sustainable development of the land and water resources degradations, scarcity and livelihoods conflicts.

2 Materials and methods

2.1 Data collection

2.1.1 *Participatory appraisals and records collection*

Required information were collected in the Usangu plain, Mbarali District, through literature survey, discussions with the stakeholders, collection of the relevant available records from the stakeholders, village level participatory appraisal (PA) tools and the formal household questionnaire survey. The total monthly and annual rainfall data for 15 years (1990–2004) were collected from the Lugerere meteorological station, in the Usangu plain, in February 2005. From the monthly total rainfall, a count of the months with total rainfall amount of more than 5 mm was made, to assess change in the pattern of the rainfall duration over years. A checklist of questions was a major tool used, to guide discussions with the professional category of informants. At the village level, discussions were focused through PA tools. In order to have greater understanding of the villages the PA tools used were: the problems focused discussions, the problem analysis chart, and the village land resources use mapping and the participatory observations. Participatory observations were used, to assess activities, physical assets and resources degradation situation on the ground.

2.1.2 *Household questionnaire survey*

A field survey of 266 households, covering six villages in the Usangu plain was conducted from April 2004 to December 2004. The Usangu plain has bowl shape land topography, thus two villages were selected for the study from the upper, middle and lower parts of the plain. Villages selected were: Mabadaga and Mhwela in upper area, which are predominantly crop growers' villages; Matebete and Yala in the middle part of the plain, which are predominantly pastoralists' villages; Sololwambo and Ikoga in the lower part of the plain, which are predominantly agro-pastoralists' villages. In these villages, the livelihoods depend on smallholder agriculture and pastoral subsistence production. The six villages are inhabited by a total of 3,090 households, thus the study sample size was about 9% of these households. Based on the total number of households of the study villages, the sampling error of selected 266 households is 2.8%, at 90% confidence level.

A questionnaire, with both the closed and open ended questions was prepared, translated into local language (Swahili), pre-tested and then improved for clarity,

relevance and sequence of questions based on experience gained during questionnaire pre-testing and PA discussions. The research team was professionals with the experience in research, extension and development activities. The professional expertises in the team were two social scientists, two livestock scientists, a natural resources management scientist, an irrigation specialist and two agricultural extension scientists. The team underwent training, on neutrality, interviewing skills and approaches. They also underwent familiarization exercise, with the questions and methods of recording responses, before interviewing the target households. The interviewees were the adult members of the household (wife or husband). A research team member therefore, interviewed one of the 266 households member.

From the literature survey it was identified that in the Usangu plain, there are three major categories of rural livelihoods production systems, which depend on the land and water resources. These were the pastoral production, crop production and agro-pastoral production systems. These production systems categories were further verified, from the villagers during the PA. It was found, it is a common knowledge among villagers, and they could easily identify households using each production system. Then for the purpose of this study, the criteria for households classification were set with the village leaders as follows: (1) the crop growers, as those households that depend on crop production activities as their livelihood means by over 50%; (2) the pastoralists, as those households that depend on pastoral production activities for their livelihood by over 50%; and (3) the agro-pastoralists, as those households that equally depend on pastoral and crop production activities by about 50% each. The estimates, of each household category in this classification revealed that approximately, the total numbers of rural households of the six study villages consist of about 2:1:1 ratio of the crop growers, pastoralists and agro-pastoralists, respectively. Thus the interviewed samples were about 9% of the total number of households from each of the three categories of the major livelihood activities (134:67:65) in the study villages.

During the execution of the survey, the village leaders assisted to identify households in each category from the up to-date village list. From the village leaders' identified categories, the required number and the reserve list of the respondent households in each category was randomly selected. At the beginning, of each questionnaire each respondent was asked to verify the category in which his/her household fall into. In rare cases, respondent identify his/her household with a different category from the one the village leaders placed his/her household. Where there were variations, the interview proceeded with the respondent indicated category, and the replacements for filling the gaps were made the following day by using the reserve list, which were pre-identified by village leaders. In villages, where there was little differentiation between livelihoods categories of households, larger number of households of the same category was selected in that village, while observing the target of 9% sample size in each category. The interviews took 2–3 days per village, with an average of four respondents per enumerator per day. The research team collected the completed questionnaires, and checked for completeness, errors, irrelevant responses and gaps to be filled for each category every evening. A short reflection meeting was organized, among research team and enumerators, every morning to rectify identified problems, if any, from the previous day interviews.

2.2 Data analysis

The qualitative information collected through PA tools were analyzed, interpreted and conclusions drawn on the spot with the participants. This ensures that the outcomes represent the current perceptions of the experienced situation by the villagers. The trends in the annual rainfall amount, estimated rainfall duration, and the quantitative data collected through the household questionnaire survey were analyzed by using the Statistical Package for Social Science (SPSS). The graphical analysis of the trends was used, for rainfall amount and duration. The counting and percentile analysis were used, to establish response proportions. The chi-square (χ^2) analysis was used, to compare the differences between proportions of the households having different experiences in relation to the land and water shortage and livelihood conflicts as: $\chi^2 = \sum [(O_i - E_i)^2 \div E_i]$, where; O_i = observed frequencies and E_i = expected frequencies. The hypothesis tested is that, proportions of the household that experience land and water shortage and livelihood conflicts are significantly different from those who do not have the problems, and the alternative hypothesis state that; the two proportions are not different. Linkages between shortage, degradation, and decline in production, conflicts and conflict frequencies were analyzed by using, the chi-square independence model: $\chi^2 = \sum_i \sum_j [\{ (A_i B_j) - (A_i B_j)_0 \}^2 \div (A_i B_j)_0]$. Where, $(A_i B_j)$ = observed and $(A_i B_j)_0$ = expected frequencies of the number of the household that reported both problem A_i and B_j ($i = 1, 2, \dots, r; j = 1, 2, \dots, s$) under assessment for relationships. The hypothesis tested is that, the problems are linked with each other, and alternative hypothesis state that, they are independent. The qualitative information collected from the visits and literature survey were analyzed by using, the content and functional structural analyses.

3 RESULTS

3.1 Land and water degradation

Traditionally, land degradation has been conceptualized in terms of biophysical change, such as measurements of soil erosion, depletion in soil moisture, nutrients and organic matter. In this work, focus was on socio-economic consequences of these biophysical forms of degradation of the land, which is the loss in economic productivity of the land, to provide local people livelihood needs. The degradation of water resources is conceived in terms of availability and suitability, in production and human domestic use for local people.

The literature survey and participatory assessment revealed that, there are resources quantity and/or quality degradation in the Usangu plain (Fig. 1a and b). The land and water degradation were reported by 68% and 67% of the respondents interviewed, respectively. This implies that, there are notable changes in quality and/or quantity of the land and water resources, to meet livelihoods needs many households. About 81% and 82% of the respondents reported that consequences of loss in land productivity are deterioration of crop productivity and increased grazing resources scarcity, respectively. The turbidity of the water resources in the source and the decline in amount of the water supply from the sources, as the main forms of degradation perceived by 52% and 91% of the respondents, respectively. The

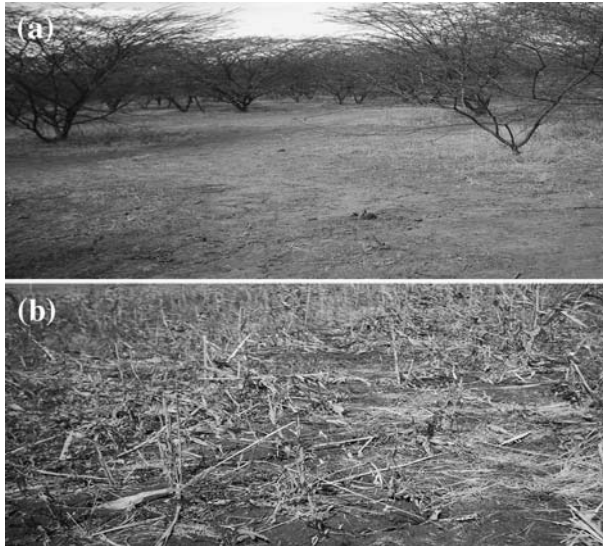


Fig. 1 Impact of land degradation in upper drier areas induced by combination of drought and low soil fertility: **(a)** shortage of grazing resources for livestock and **(b)** low crop productivity for food and incomes of farmers in the Usangu plain, SW Tanzania. *Source:* Field observations (2004)

decline in quality of land creates need for additional space or quantity of the resources for livelihoods production activities. The additional needs due to low quality of land or water resource create the shortage and competition over these resources for the livelihood. Malley (2005) found that continuous cultivation, expansion of crop production areas, low use of fertilizer input, low use of conservation farming measures, inefficient irrigation structures and repetitive grazing were the major human activities that causes the land and water degradation.

3.2 Land and water resources scarcities

Out of the 266 households interviewed 76% and 93% have reported that, they experience the shortage of the land and water resources, respectively. The shortage is experienced in production activities and for the domestic use. The chi-square test indicates these proportions of the households are significantly ($p < 0.001$) higher, than those who do not experience the shortage of these resources. However, the results indicate that water shortage ($\chi^2 = 195.4$, $df = 1$) is more critical problem, than land shortage ($\chi^2 = 61.6$, $df = 1$) in the Usangu plain. Similarly, Mwalukasa (2002) has reported that, among 80 households 63% had the land and 75% had the water scarcity problems, in the Matamba-Chimala basin, of the Usangu plain. The household survey showed that, in the wet period of the year, about 78% and 68% of crop producers experience the land and the water scarcity for crop production, respectively (Fig. 2). About 94% of the pastoralists reported the problem; of land shortage that creates need for additional grazing lands, in the dry season (Fig. 2). Household survey revealed that, 99% of the livestock producers do not experience water shortage during the wet period of the year (Fig. 2), but during the dry season.

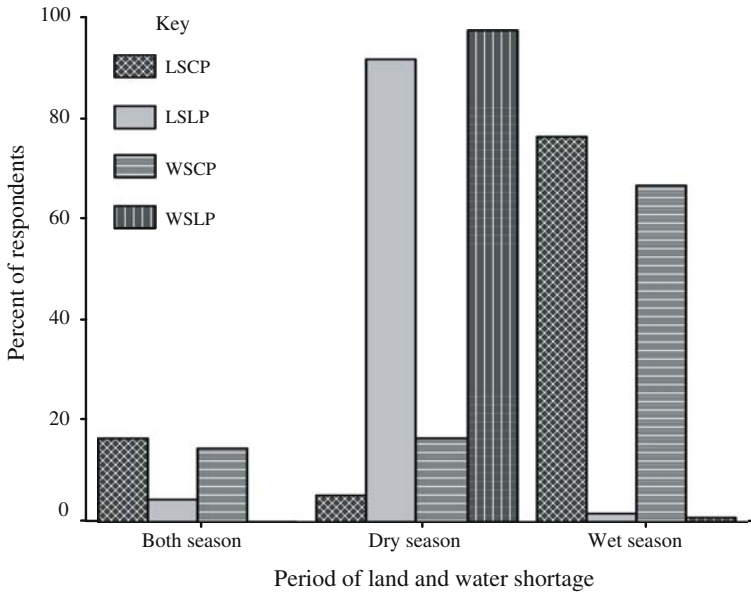


Fig. 2 Period in which land and water shortages are experienced for different livelihood production activities in the Usangu plain, SW Tanzania. *Source:* Field data (2004). LSCP = land shortage for crop production; LSLP = land shortage for livestock production; WSCP = water shortage for crop production; WSLP = water shortage for livestock production

3.3 Causes of land shortage

3.3.1 Decline in soil fertility and low moisture supply

The PA of all six-study villages revealed that, farmers perceive that the soil fertility has declined. This was further reiterated by 43% of the respondents in the household survey (Table 1). Farmers and extension workers asserted that, the use of nitrogen and phosphate fertilizers result into higher yields of cereals, in years with good rainfall. The average maize yield is about 2.5 t/ha when fertilizers are used, compared to 1.3 t/ha when fertilizers are not used. The rice average yield of well to do farmers using fertilizers is about 4.8 t/ha, while for those not using fertilizers get about 2.7 t/ha. The soil analysis by Mwalukasa (2002) showed that, the high productivity soil has 34.2 g/kg of organic carbon, while; the low productivity soil has 19.2 g/kg of organic carbon. A main adaptation strategy used by farmers is to shift to new productive plots for growing crops. In four villages, low soil moisture supply was reported and ranked high, as an important reason of low land productivity. In these villages, the low rainfall coupled with decreasing access to sources of irrigation water, made fertile land not usable for crop production. The drought and low soil fertility, cause shortage of grazing resources and failure in crop production, in upper parts of the Usangu plain ecosystem (Fig. 1a, b).

3.3.2 Increased demographic pressure

About 44%, 48% and 41% of the respondents reported that, the uncontrolled in-migration of the farmers and the pastoralists in 1970s to 1990s; and the increase of

Table 1 Reasons for land and water shortages in the Usangu plain, SW Tanzania

Reasons for shortage	Percentage of respondents					
	Land (<i>N</i> = 201)			Water (<i>N</i> = 247)		
	<i>N</i>	RF (%)	Rank	<i>N</i>	RF (%)	Rank
Increase in human population	82	40.8	4	78	31.6	6
Immigration of pastoralists	97	48.3	1	87	35.2	4
Immigration of farmers	89	44.3	2	74	30.0	8
Land use conversion	75	37.3	6	30	12.1	11
Increased livestock population	78	38.8	5	71	28.7	9
Soil fertility & area expansion	87	43.3	3	85	31.0	7
Land tenure/distribution	46	22.9	8	–	–	–
Uncontrolled fires and burning	72	35.8	7	64	25.9	10
Increased water use	–	–	–	116	47.0	3
Water losses in the canal	–	–	–	82	33.2	5
Shortening rain duration	–	–	–	205	83.0	1
Decreased amount of rain	–	–	–	204	82.6	2

RF = Relative frequency

Source: Field data (2004)

the local demographic pressure, caused the current land shortage, respectively (Table 1). Increase in demography, is supported by SMWUC (2002) study, which indicated that population grew from 115, 947 people in 1978 to 211,762 people in 1999, in Mbarali District. Due to this population growth, the population density has almost doubled in the agricultural land, from about 25 to 47 people per square kilometre. About 44% of the respondents showed that, the increasing numbers of the farmers in the plain have caused the expansion of the irrigated land areas, thus degradation of the resources quality and/or quantity. This is in agreement with the study of Mwalukasa (2002) that, the irrigated crop area has steadily increased since 1963 to 2001. Sosovele and Ngwale (2002) reported growth of irrigated area from about 10,000 ha in 1970 to 45,000 ha in 2001. SMUWC (2002) reported that expansions of irrigated agricultural areas, causes water shortage for other uses in the Usangu plain.

3.3.3 Land use conversions

In the study area, five villages of the six studied and 37% of the 266 respondents reported that, conversion of the eastern wetlands to the game reserve, increased land and water shortage for the agricultural production activities in the villages (Table 1). The eastern wetland is an important area for pastoralists and agro-pastoralists adaptation, to the livestock production grazing and water stresses during the dry seasons (Fig. 3). This is evident from the facts that, 94% and 99% of the pastoralists reported problems of the grazing land and water for their livestock in the dry season, respectively (Fig. 2). The shortage, increased prominently due to the expansion of the former game controlled area. In 1998 the game controlled area, in the Utengule swamps increased from 500 sq km to 5200 sq km, and was elevated into the Usangu game reserve. Another, 172 sq km converted into the protected forest reserves, causes livelihoods insecurity through reduced access to thatching materials, building poles and other forest products, which are derived from this land before the conversion.



Fig. 3 Eastern wetlands adaptive use by the pastoralists during the dry season as the pasture conditions and swamps allows sustenance of the livestock production in the Usangu plain, SW Tanzania. *Source:* Field observation (2004)

3.3.4 Uncontrolled fire and deliberate burning

A significant proportion (36%) of respondents showed that, uncontrolled fire and deliberate burning destroys grazing resources, on which livestock survive for several months in the dry season (Table 1). This is the problem in the wet season grazing areas, at the onset of the dry season. This situation is blamed on, hunters, charcoal makers, and the crop farmers' methods of land clearing. Pastoralists reported cattle envy attitudes of farmers, as a cause of deliberate burning of the grazing resources.

3.4 Causes of water scarcity

The scientists, policy makers and resource users agree that, amount of water available and duration of availability have significantly changed in the Usangu plain, but the causes remained debatable. SMUWC (2002) report show that, anecdotal evidence consistently suggests that rainfall has declined over years. However, detailed analysis of rainfall data over many years in the Usangu catchments and plain show insignificant decline in overall average rainfall amount. This may suggests that, the problem is an increase in the annual rainfall amount variability, rather than average rainfall amount decline. In this study, the degradation of the water sources was reported in all the six villages, this was consistently highly ranked as the important reason for the water shortage (Malley, 2005). About 83% of respondents attributed, the scarcity of water to decline in rainfall amount over the years, in the Usangu plain (Table 1). Furthermore, same number of the respondents indicated that, rainfall duration is becoming shorter, and discussions with villagers show that, the pattern is more unreliable today than in the past. The analysis of the rainfall data, over 15 years (1990–2004) collected from the Lugerere meteorological station, within the Usangu plain showed that, the rainfall amount annual variability has increased since mid 1990s to date (Fig. 5). The analysis further showed, a trend of the rainfall duration getting shorter over time in the Usangu plain (Fig. 6). This is evident from the fact that, higher frequencies of the wettest and driest seasons were found in the second half of the 1990s (Fig. 5). Furthermore, in the early 1990s the 500 to 600 mm of the annual rainfall was distributed over 6 months, but in 1998 and

2002 more than 800 mm of the annual rainfall were distributed over 5 months (Fig. 6). This is also in agreement with the finding of Sosovele and Ngwale (2002) that, both the pattern and duration of rainfall have changed in the Usangu plain. They supported their argument by analysis of the annual rainfall amount for over 20 years (1980–2000), using the data from the Mbarali station in the Usangu plain.

3.5 Land and water conflicts and its extent

Numbers of the households with conflicts over land and water resources are higher in the study villages, except, in Sololwambo village, than those without conflicts (Table 2). In the overall sample of 266 households, 68.8% reported conflicts over land and water resources. The chi-square test ($\chi^2 = 37.6$, at $df = 1$) showed that this proportion of the households, experiencing the land and water conflicts, is significantly ($p < 0.001$) different from that without conflicts. The fact that higher proportions of households are experiencing conflicts, in five villages of the six studied, confirms existence and the widespread of the land and water use conflicts in the Usangu plain. Further analysis show that, out of the 183 households that reported conflict over the land or water resources, about 56% had two or more conflicts events. Verbal conflicts events were many, followed by those conflicts that reached an extent of fighting, and filing cases in the courts (Table 2). The fighting and cases in court or elders council is an advanced stage of verbal conflicts that had occurred. This means that currently, about 12% of the verbal conflicts reach an extent of fighting each other; similar numbers go to the courts, and to the elders' councils for resolutions. In Ikoga village, there were more conflicts in the courts, and fighting cases, than in other villages. This is caused by arresting of villagers by the game reserve rangers, due to fishing or grazing in the game reserve.

Table 2 Households (HH) with conflicts over land and water resources in the Usangu plain, SW Tanzania

Conflicts attribute	Extent of conflicts in the study villages (% of respondents)						
	Mabadaga	Matebete	Mhwela	Yala	Sololwambo	Ikoga	Total
Presence of conflicts	<i>N</i> = 266						
HH with conflicts	9.8	21.4	9.0	9.0	4.9	14.7	68.8
HH without conflict	3.4	7.9	5.3	6.0	6.4	2.3	31.2
Total	13.2	29.3	14.3	15.0	11.3	16.9	100
Conflicts per HH	<i>N</i> = 183						
One conflict event	4.0	12.0	6.0	8.7	6.0	7.0	43.7
Two conflict events	7.0	8.0	5.0	2.2	1.1	8.2	31.5
Three conflict events	4.0	11.5	1.1	2.2	0.0	6.0	24.8
Total	15.0	31.5	12.1	13.1	7.1	21.2	100
Kind of conflicts	<i>N</i> = 183						
Verbal accusation	9.8	11.5	10.9	10.9	6.0	10.9	60.0
Case in elders council	1.1	3.3	1.1	1.6	0.6	3.8	11.5
Destroying property	0.6	1.6	0.0	0.6	1.6	2.2	5.0
Fighting	2.7	1.6	1.6	1.1	0.6	4.4	12.0
Case in the court	2.2	1.6	1.1	1.1	0.6	4.9	11.5
Total	16.4	19.6	14.7	13.7	9.4	26.2	100

Source: Field data (2004)

3.5.1 Analysis of conflicts

An in-depth analysis of the livelihoods conflicts, over the land and water use is presented in Table 3. The crop growers have conflicts among themselves, and with the pastoralists and agro-pastoralists. The analysis shows that, farmer versus farmer conflicts over the land and water resources, form 82% of the relative frequency. The reported conflicts by the livelihood groups, involving farmers versus pastoralists, and farmers versus agro-pastoralists, were 90–91% and 73–78% of the relative frequencies, respectively (Table 3). Farmers have few conflicts with the government departments; pastoralists have high conflict frequency with agro-pastoralists, and with the government departments. The majority (47%) of the agro-pastoralists have conflicts with the government departments; substantial proportion had conflicts among themselves (Table 3). The government natural resources department is the one with many conflicts, with pastoralists and agro-pastoralists, particularly game reserve officials.

Generally conflicts occur in the dry and wet seasons, depending on the livelihood activity. Results of the household interviews in Fig. 4 show that, 84% of the pastoralists, 52% of the agro-pastoralists and 35% of the farmers indicated conflicts occurrence in the dry seasons. In the wet seasons, the reverse is the case, whereby, 51% of the farmers, 44% of the agro-pastoralists and 10% of the pastoralists, indicated occurrence of the conflicts. The higher conflicts incidence to the pastoralists in the dry seasons indicate that, livestock production activity face land and water resource shortage in the dry seasons, compared, to the crop farming activities. The agro-pastoralists use the crop residues on their farms, to feed their livestock for sometime in the dry seasons. This reduces the length of the period for conflicts occurrence to them over the grazing land shortage in the dry period, as compared to

Table 3 Livelihood conflicts among and between major land and water users in the Usangu plain, SW Tanzania

Parties in conflicts	N	Relative frequency (%)
<i>Farmers livelihood conflicts (N = 85)</i>		
Farmer versus farmer	70	82
Farmer versus pastoralist	77	91
Farmer versus agro-pastoralist	66	78
Farmer versus government departments	18	21
Farmer versus large rice schemes	6	7
<i>Pastoralists livelihood conflicts (N = 51)</i>		
Pastoralist versus pastoralist	6	12
Pastoralist versus farmer	46	90
Pastoralist versus agro-pastoralist	8	16
Pastoralist versus government departments	14	28
Pastoralists versus large rice schemes	4	8
<i>Agro-pastoralists livelihood conflicts (N = 47)</i>		
Agro-pastoralist versus agro-pastoralist	9	19
Agro-pastoralist versus farmer	34	73
Agro-pastoralist versus pastoralist	6	13
Agro-pastoralist versus government departments	22	47
Agro-pastoralist versus large rice schemes	2	4

Source: Field data (2004)

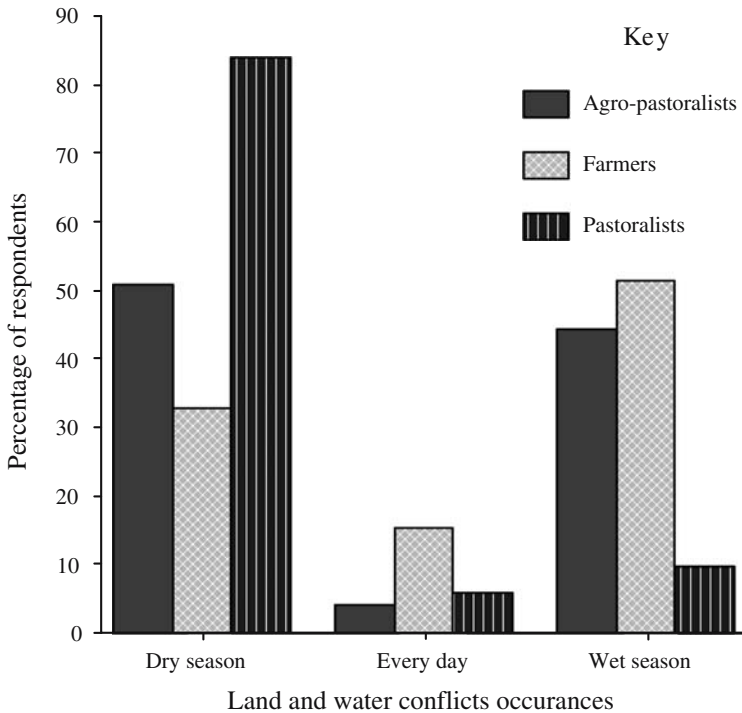


Fig. 4 Frequency of land and water conflicts occurrence in different periods of the year, to different livelihood groups in the Usangu plain, SW Tanzania. *Source:* Field data (2004)

the pastoralists. During the wet seasons, the crop producers compete among themselves, over the irrigation water in the paddy fields, while the pastoralists depend on the ponds, for livestock watering. More or less, the same proportion of the agro-pastoralists, experience conflicts in dry and wet seasons. This is explained by the fact that, they depend equally on the crop and livestock production activities, and many of them depend on the run-on floods for paddy production, than farmers.

3.6 Causes of livelihoods conflicts

3.6.1 Land and water shortage

The land and water scarcity, for production is a main factor causing livelihoods contests, in the Usangu plain. The conflicts related to crop-livestock competitions, over the scarce land and water resources across the overall livelihoods categories were reported by 69% of the respondents (Table 4). The reasons for the conflicts, reported by the crop farmers' livelihoods category, were livestock entering crop fields and destroying the crops, livestock entering the irrigated field, causing damages of the irrigation canals and furrows. While, the pastoralists and agro-pastoralists reported that, farmers cause damages to the cattle limbs, when entered their crop fields accidentally; farmers poison the crop residues to kill cattle; and farmers invade the grazing land for cultivation (Table 4). In a joint meeting these reasons were

Table 4 Reasons leading to land and water use conflicts in the Usangu plain, SW Tanzania (% of respondents with conflicts)

Reasons of conflicts over land and water	Farmers (N = 85)	Pastoralists (N = 51)	Agro-pastoralists (N = 47)	Overall (N = 183)
Struggle for irrigation water	64.7	0.0	31.9	38.3
Crop damage by livestock	34.1	60.8	42.6	43.3
Furrows and canals damage by livestock	4.7	13.7	2.1	6.6
Farm land and boundary disputes	20.0	2.0	2.9	11.5
Grazing in game reserve	0.0	39.2	42.6	21.8
Scramble for domestic water	7.1	0.0	6.4	4.9
Damages to livestock limbs and poisoning	0.0	2.0	2.1	6.1
Grazing–farming land disputes	3.5	39.2	2.1	13.1
Livestock thefts	0.0	0.0	4.3	1.1

Source: Field data (2004)

accepted by all the categories of the livelihood groups, as causes of the conflicts between herders and farmers.

3.6.2 Competition over cropping and grazing land

Field assessments and literature showed that, farm plots conflicts occur over ownership or user rights, invasions or encroachments of boundaries, among the crop growers. This was verified by 20% of the crop growers’ households. About 39% of the pastoralists had disputed with the farmers, over the extension of cultivation or invasion of the grazing areas (Table 4). An in-depth analysis of the farm-grazing lands conflicts revealed that, land user rights for the crop production activities are recognized, accepted by policy-makers, but the reverse is the case for the pastoral production activities.

3.7 Link between resources scarcities, degradations, conflicts and livelihood activities

The linear associations between resources shortage and degradation, livelihood conflicts to resources shortage, and decline in production in the Usangu plain are presented in Table 5. There are significant associations ($p < 0.05$), between perceived degradation of resources, with experienced shortage, and the water shortage to the conflicts. However, the association of the conflicts to the land shortage, is significant at $p = 0.051$. These results suggest that, resources scarcities are linked to their degradation and livelihood conflicts. The perceived decline, in crop production is highly associated ($p = 0.009$), to the period of the conflict occurrence to the crop growers. The period in which water shortage is experienced for the crop production activities is highly associated ($p < 0.001$), with the period in which conflicts occur, to the crop growers. Period of the land shortage occurrence, for the livestock production activities, is associated with conflicts at $p = 0.061$. Pastoral production activities, experience land shortage, due to shortage of dry season pasture, in the wet season grazing areas. The land degradation, the period of the land shortage for crop production, and the livestock production decline, are not associated ($p = 0.10$) with the conflicts (Table 5).

Table 5 Linear associations between resources scarcity, degradation, decline in production, conflicts and period of conflicts occurrence

Associations between problems	Linear association	Level of significance
<i>Resources shortages versus their degradations</i>		
Land shortage versus decline land productivity	66.6	0.000
Water shortage versus decline in water suitability	18.6	0.000
<i>Resources shortages versus conflicts</i>		
Land shortage versus conflicts	3.8	0.051
Water shortage versus conflicts	4.4	0.037
<i>Resources degradations versus conflicts</i>		
Decline land productivity versus conflicts	2.2	0.139
Decline in water quality versus conflicts	2.6	0.069
<i>Decline in production versus conflicts</i>		
Decline in crop production versus conflicts	6.8	0.009
Decline in livestock production versus conflicts	2.5	0.114
<i>Time of land shortage versus conflicts frequency</i>		
For livestock production	3.5	0.061
For crop production	1.02	0.312
<i>Time of water shortage versus conflicts frequency</i>		
For crop production	13.8	0.000
For livestock production	***	–

*** All livestock keepers experience water shortage problem in dry season

Source: Field data (2004)

4 Discussions

4.1 Resources scarcity, livelihoods and degradation process interactions

The land shortage is both a function of time of need, land space and quality that are required to meet livelihood need of the user. A piece of a good quality land that provides adequate products, all the time for the livelihoods of the user, reduces need for large space, and the reverse is true for a poor land quality. In the Usangu plain, the study showed that, 76% experience shortage of the land. The underlying factor for the land scarcity, in the Usangu plain, is its low productive quality, which causes demand of additional space, at certain time of the year, to meet the livelihoods needs of the users. This is caused by a combination of degradation, through depletion of the soil fertility by continuous cultivation, and the low soil moisture availability due to drought. As a result of the land failure to provide adequate production for crop growers, extension and shift cultivation into new areas, that are fertile and/or with high soil moisture retention capacity, was an adaptive way used by farmers, as a means of production loss compensation. EDC News (2001a), reported similar adaptation in Africa. The UNU/IAS (2004) argue that shortage of good land, fertile soil and moisture supply, may undermine productivity of rural people, and threaten livelihoods that lead to social conflicts. The association found between land degradation, nature of land and water scarcity, and livelihood conflicts in the Usangu plain, supports this argument.

The shortage of the water as that of land is a function, of time of need, quantity and quality. In the Usangu plain, shortage of water is experienced by all livelihoods production activities. The local people mainly attribute the problem to increasing drought frequencies. About 83% of the people perceive that, the decrease in the

rainfall amount and duration causes the problem. These villagers’ arguments and perceptions are supported by analysis of rainfall variability pattern, that depicts increase in drought frequencies and decline in rainfall duration (Figs. 5 and 6). This is in agreement with Karl, Knight, and Plummer (1995) arguments that, with the environmental changes the rainfall variability increases, droughts will become more frequent and intense, and rainfall will be concentrated in short and severe storms. Presently, the water for domestic use is a problem in the Usangu plain, because the streams and springs used in the past now dry up, during the dry season. According to Mbaria (2005), these are indicators of the environmental degradation. He further argues that, loss of vegetation is strongly linked to rainfall amount variability, and decreased quantity. In the Usangu plain, the deforestation due to wood harvesting for livelihoods, the extension and shifting cultivation, caused by depleted soil fertility, degrades the land vegetation cover and sources of water. The degradation of the land vegetation causes increased climatic variability, which in turn leads to environmental insecurity. The removal of vegetation cover affects the rainfall-producing convection circulation in the local area, leading to decline in rainfall (Eriksen, 2001). Eriksen argue that as the vegetation and canopy cover decrease, the shortwave reflection coefficient (albedo) at the land surface increases, this result into reduced latent and sensible heat. In this process, the evapo-transpiration is reduced, due to decreased net radiation at the surface. Reduction of evapo-transpiration creates dry conditions in the air. This occurs, due to disruption in the natural processes of forming tiny droplets, originating from the ground water and vegetation, which latter fall as rains. In addition, degradation of vegetation cover, leads to

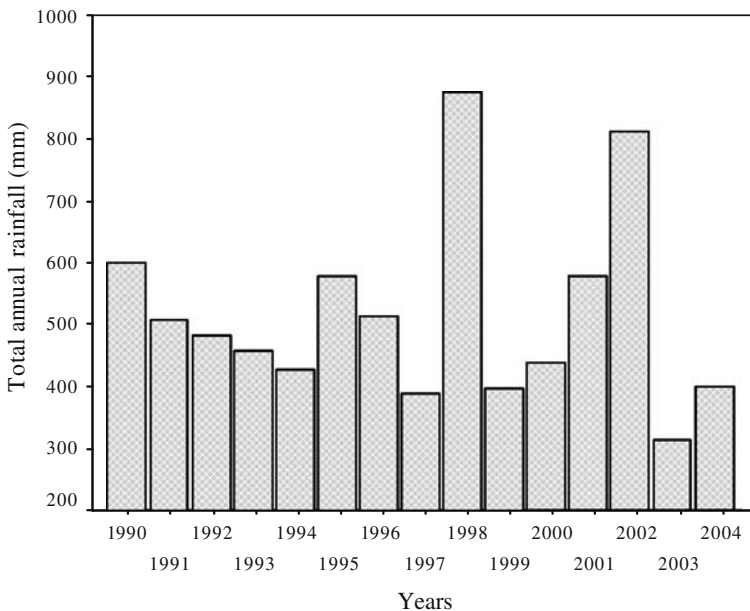


Fig. 5 The trend of the annual rainfall over 15 years at the Lugerere meteorological station in the Usangu plain, SW Tanzania *Source:* Own analysis based on rainfall data measured at Lugerere station

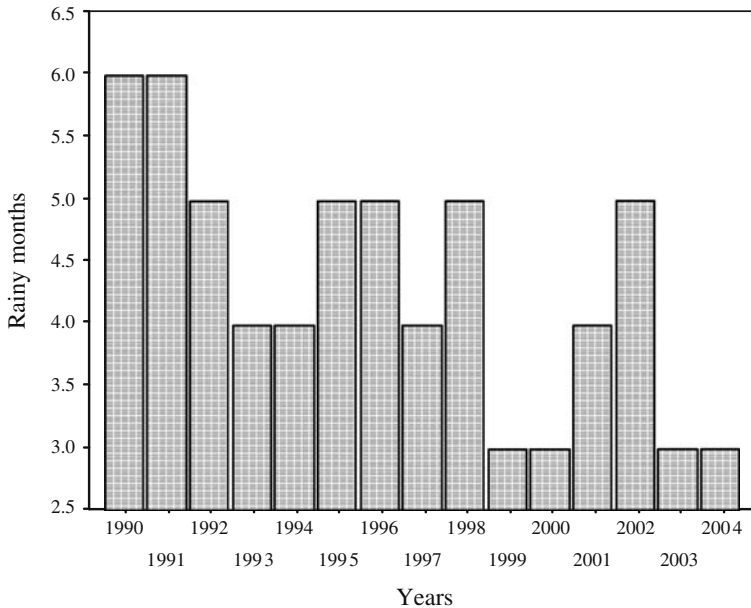


Fig. 6 The number of the rainy months with above 5 mm over 15 years at the Lugerere meteorological station in the Usangu plain, SW Tanzania *Source:* Own analysis based on rainfall data recorded at the Lugerere station

reduced interception of rainfall, and therefore precipitation is lost from the local area as run-off (Henderson-Sellers, Dickson, & Wilson, 1988). This contributes to low recycling of water, into the atmosphere from the local area. Eltahir and Bras (1994) found that 25% of the precipitation is from the recycled ground water in the Amazon basin through evapo-transpiration. Hulme and Kelly (1993) pointed out that, degradation of vegetation reduces potential atmospheric carbon sink. The vegetation cover sequesters the carbon dioxide gas, the most important greenhouse gas in terms of climate change. This is one of the mechanisms, which mitigate the climate variability. The absence of vegetation is associated with increased drought frequencies, which causes environmental insecurity (Karl et al., 1995). The impacts of environmental insecurity are low productivity of livestock, rainfed and irrigation agriculture, and conflicts over this resource among farmers, and between herders and farmers.

4.2 Nature of livelihoods conflicts

The analysis of the livelihoods conflicts in the Usangu plain over land and water resources can be grouped into three as: (1) conflicts among the same livelihood groups; (2) conflicts between different livelihoods groups; and (3) conflicts between the state and the livelihoods groups. The livelihoods groups were determined by major livelihoods means of the people. In this study, three major livelihoods groups were identified: (1) the pre-dominantly crop growers (farmers); (2) the pre-dominantly livestock keepers (pastoralists); and (3) the pre-dominantly, crop-livestock mixed farmers (agro-pastoralists).

4.2.1 *Conflicts among the same livelihood groups*

The conflicts among livelihoods groups are: (1) among farmers over farm plots and the boundary disputes and over irrigation water, (2) among pastoralists over grazing resources. The livelihoods conflicts analyses show high frequency of the conflict events among farmers (Table 3). Competitions over water for paddy irrigation, underscore the prominence of farmer versus farmer conflicts. This is evident from the fact that, 65% and 32% of the conflicts events among the farmers and the agro-pastoralists were over irrigation water, respectively (Table 4). This is explained by the fact that, rice is the most important crop for cash income to its growers, leading to a stiff competition over irrigation water, among the irrigators. In the Usangu plain, the rice production depends on run-on floods and re-charging of the rivers by rainfall, as the main sources of water for flooding the rice fields. This show the reason for the high conflicts occurrences to crop growers, during the rainy season, than other livelihoods groups (Fig. 2). The households that have settled downstream blame the upstream users, due to total abstraction of river flows to an extent that downstream users go upstream for water. Currently, the perennial rivers dry up during the dry season, as a result of decline of water flows due to the degradation of water sources in the uplands. This situation is worsened, due to increased incidences of droughts, and irregularity in rainy season.

Literature indicated that, ethnicity is another factor that may results into resources conflicts, for example, a study by Kajembe et al., (2003), in the Usangu plain, show that 50% of the 165 respondents reported bad relationships between ethnic groups. This has been the case in the study villages; villagers confirmed that, the occurrence and mediation of conflicts are influenced by ethnicity, culture and livelihood activity. Furthermore, over 26 ethnic groups constitute the households that predominantly depend on crop farming, had high frequency of the conflicts among themselves, while, the pastoralists had low ethnic diversity, had low conflicts frequency among themselves. Similarly, there was a medium diversity, in ethnicity and conflict frequency in agro-pastoralists livelihood group. The agro-pastoralist livelihood group is made up, of the pastoralists and the farmers adopting agro-pastoral way of life, a main livelihood system traditionally used by the Sukuma and Nyamwezi ethnic groups in the area.

4.2.2 *Conflicts between the livelihood groups*

Main conflicts, in this category are the conflicts between farmers and herders, over the land and water use for the livelihoods activities. The conflicts, between farmers and agro-pastoralists, and between farmers and pastoralists, are over the crop-livestock production practices interactions. The situation, which leads to conflicts, between herders and farmers, is the insensitivity of farmers to the need of the pastoralists, on the access to the crop residues and water in the irrigated areas, during the dry season. The resources competition conflicts, between production systems were prominent where: (1) the pastoralists, are allocated area for grazing with poor pasture and/or that lack water sources for the livestock watering; (2) livestock corridors, to water sources are blocked by farms; (3) herders, are prevented to graze crop residues, and livestock production activity is prevented to share water sources with other uses; and (4) farmers, encroached the fertile land into areas, designated as gazing areas. These claims are evident from the fact that, 61% of

the pastoralists and 43% of the agro-pastoralists reported the conflicts events, of their livestock damages of crops as a reason of conflicts that occurred to them (Table 4). The marginality, of the grazing lands to provide adequate grazing resources, during the dry season (Fig. 1a), is a main situation which forces the livestock keepers to graze in the vicinity of the cropped land and the water sources. These adaptive strategies mitigate the impact of the scarcity of the grazing resources and water, on livestock production. The herders' views of access to crop residues during the dry season, and sharing the sources of water, with irrigation and domestic activities are in conflicts with those of farmers. On their side farmers', stick on the traditional views, promoted by the professionals that livestock should be maintained on the grazing lands through out the year. These latter views, neglect the reality that, the grazing land has no grazing resources, and that the livestock watering dams dry up, during the dry seasons.

4.2.3 Conflicts between the state and the livelihood groups

The problems of scarcity of land and water, for livestock production occur in the dry season, as revealed in Fig. 2. This is associated with the high conflicts frequencies to pastoralists and agro-pastoralists in Fig. 4. The land scarcity problem is caused by, depletion of pastures for grazing in dry period of the year, in the upper fans grazing areas (Fig. 1a). The land and water scarcity problems are low to the livestock keepers, during the wet season, due to the fact that swamps and ponds meet need for watering cattle, and grazing pastures have regenerated in the upper fans. The scarcities of land and water in the dry season for the livestock create a need, for other grazing areas and watering sources. The pastoralists and agro-pastoralists in the Usangu plain, have established transhumance adaptation system to mitigate problems of land and water, during the dry season. The system involves seasonal movement, between drier upper areas and the wetlands areas. The wetlands are flooded during the wet season, but during the dry season, provide the good quality grazing resources and water sources for the livestock (Fig. 3). This land utilization system, of pastoral societies observes sustainability of livelihoods, and of the resources utilization based on time, space and quality. However, this movement system of resources utilization by the pastoralists has been under attack, by natural resources workers, especially the wildlife department in Tanzania, as a cause of the degradation of the environment. This premise of argument has been used by wildlife department, to convince the policy makers to alienate land from pastoral production use, in favour of tourism objective, of the wildlife department. This land alienation policy is main cause of conflict, between the government and the traditional livestock keepers.

4.3 Link of resources scarcity to livelihood conflicts

The pattern of conflicts occurrence in Fig. 4, correlate with the seasonal land and water shortage, for the crop and livestock production activities reported in Fig. 2. This relationship suggests that, the livelihood conflicts are over the scarce land and water resources, in time of need for the livelihood production activities. An in-depth analysis showed that, the livelihood conflicts are strongly linked to the decline in crop production, the water shortage, and the period of water shortage (Table 5). These results suggest that, the water shortage is linked to the loss of the rural

livelihoods and increasing insecurity, in the Usangu plain, in terms of time of need and quantity needed for crop and livestock production. The linear regression estimate, of average cereal production trend depicted a decline over years, from about 114,000 in 1990 to 100,000 tonnes in 2003 (Malley, Taeb, Matsumoto, & Takeya, 2006). This trend is described by 39.3% of the variations in total annual rainfall amount, received during the period (Malley et al., 2006). The direct impact of drought on livestock is the scarcity of grazing resources (Fig. 1a), which in turn causes low milk production. This is evident from the fact that 88.4% of livestock keepers, who perceived that the land productivity has declined, indicated decline in average milk yield (litres/cow/day) from 3 in 1980s to 1.2 in 2000s. These indicate that in the Usangu plain, the low productivity of the land related to soil moisture stress, which creates the need for the more space for adaptation to the production activity, which in turn leads to the farmer versus farmer and the herder versus farmer conflicts. This situation is similar to that reported by the EDC News, (2001a) in Garissa, eastern Kenya, where, the livelihood conflicts were caused by adaptive ways used to cope with problem of drought. This implies that environmental insecurity has a link to the ailing situation, of agriculture and livestock production activities, for decent and peaceful sustainable livelihood in the study area.

4.4 Link of conflicts to development policies

In Tanzania, the offered land user rights recognize crop production activity, but not the pastoral production activity. The agricultural policy encourages expansion of the crop areas, as means to increase food production, while neglecting the needs and rights of traditional livestock keepers. These are evident from the attitudes of the ward and district authorities, taking side with the cultivators that invade the pastoralists grazing land in Matebete village. In the course of conflicts, the authorities and the invaders, ignore the fact that pastoralists are the owners of the grazing land title deed. The title deed was transferred to pastoralists after paying an outstanding loan of the Usangu-Mbeya Cooperation (USAMBECO) ranch to the Cooperative and Rural Development Bank (CRDB). Conversion of the dry season grazing land in Ikoga village, to become part of the Usangu game reserve, is another example that shows that, pastoral activities land rights are not honoured by the authorities. The 1999, land policy empowers the village governments, to allocate village land into grazing and cropping areas. However, the land use conversion decision of the eastern wetlands, into game reserve, neglected the Ikoga village land use plan of the grazing land, during the dry season. Furthermore, the implementation of this policy, in predominantly crop farmers' villages, allocated the degraded land to the pastoral production activities, and the crop farms, were allocated in the cattle corridors to the water sources.

A policy of converting the use of the eastern wetlands, into game reserve, has disrupted the adaptive pattern of the pastoralists and agro-pastoralists lives. This is due to prohibited access to the dry season grazing and water resources for livestock production. As a way to the local adaptation, more herders are compelled to graze their livestock on the crop residues, pasture along the irrigation canals, fallowed plots, and along the furrows, in the cropping areas. This shows that the policy of alienating the eastern wetlands grazing area, and its swamps in 1998, for the wildlife, had intensified the herder versus farmer conflicts. In addition, the policy has lead to conflicts, between the state and the pastoralists and agro-pastoralists, over their

livelihoods. These are evidenced by the facts that, more agro-pastoralists and pastoralists have conflicts with the government departments (Table 3), and that about 84% and 52% of the pastoralists and agro-pastoralists proportions are having conflicts over water and land resources, respectively.

The pastoralists' livelihoods conflict is linked to, the policy formulation processes, which neglect the pastoral production system, in the development process. This is one of the factors, which exacerbate livelihoods vulnerability of the pastoral societies. This is shown by the severe deterioration of veterinary services, in the Usangu plain. The evidence of the neglect, is from the fact that number of working cattle deeps has decreased from 19 operating in 1998 to eight only in 2002, and none of the established 10 livestock health centres was operating in 2004. The livestock sub-sector, policy formulation has been based on modernization and commercialization concepts, which emphasize use of exotic breeds, beef cattle ranches and dairy cattle farms. These concepts were built on a different set of objective, environment and knowledge systems that is not consistent with pastoral societies' objective, production environment and traditional skills and knowledge of livestock production. This situation presents, a great limitation, to implementation of these policies in the context of pastoral societies' development, due to its great isolation from their objectives, environment and the knowledge system. The skills and knowledge, of the dynamic traditional pastoral production practices is based on adaptive ways to the livelihood security, in the harsh natural environments they live. However, these adaptive practices are neglected in the process of policy formulation, even branded outdated traditions that should be changed, through forceful sedentarization of pastoralists. The consequences, of embracing these negative views by policy makers were: (1) lack of innovative strategy, to establish traditional pastoral rangelands, and their improvement programs; (2) national livestock research and extension services are tailored to exotic practices, the dairy farming and the beef cattle ranches, while sidelining improvement of pastoral production practices.

4.5 Implications for sustainable development

Sustainable development is about people and their sustainable livelihoods. The livelihood sustainability is process of building, the existing strengths (assets or capital endowments) and capacities of the people, so that they can convert them into positive livelihoods outcomes. The land and water resources are key natural capital assets for sustainability of livelihoods, because they form basis of many rural economies and environmental benefits. Sustainability of the quality of land and water is essential, for the sustainability of rural economies and environment. The results of this work show that, land and water resources are in short supply, due to their quality and/or quantity degradation, in the Usangu plain, which has resulted into health risks and livelihoods conflict over these resources. The turbidity of water in the sources due to sedimentation from the uplands was reported by 52% of the respondents, as a form of water quality degradation in the Usangu plain. About 27% of respondents lost their household members to diarrhoea. The diarrhoea problem is linked to use of water from sources with the sediment loads, from the uplands, and low level of the sanitation, due to water scarcity for domestic use, in the dry seasons. Other 43% of respondents, lost household members due to Malaria, which is linked to seasonal water ponds formed as a result of the floods, which spill out, due to silting up of the rivers and/or streams. This implies that, land and water resources quality

management is a paramount task, for a progress to sustainable development goals and rural poverty reduction.

The development of human qualities, such as positive attitudes and aptitudes, and harnessing local skills and knowledge, are essential assets in the planning for the livelihood sustainability. This case study, of the Usangu plain, revealed that, this important aspect of the sustainable development is neglected, in environmental policy formulation in Tanzania. The local skills and knowledge are despised, as not only inferior but also anti-developmental, thus should be forcefully changed, in order to achieve sustainable development goals. This implies, the policy makers failure, to recognize the facts that: (1) today's rural generations have survived, by depending on the dynamic and diverse skills and knowledge of their fore-parents; and (2) improved local aptitudes, skills and knowledge are essential livelihood assets in today's development efforts, so as to make, the effective use of other capital assets for sustainable development.

The important social qualities, required in sustainable livelihood are trust, closeness and solidarity. These are important social assets for increased wellbeing, and facilitation of generation of other capital assets, in the pursuance of sustainable development. The conflicts among and between, the livelihoods groups, and between the livelihoods groups with the state, implies that this form of the capital asset is weak, and have not been harnessed for sustainable development.

5 Conclusions and recommendations

5.1 Conclusions

The three major dimensions of the land and water scarcities prevail, in the study area: (1) the scarcity of the suitable land, and amount of water for production; (2) the scarcity, induced by the degradation, of the quality and/or quantity of the land and water resources, to meet need for the livelihood; and (3) the time bound scarcity, in terms of period of resources needed for production activities.

The rural livelihood conflicts, over the access to the scarce land and water resources exist, in the Usangu plain, southwestern Tanzania. The conflicts are widespread, between and among resource users. The prominent livelihood conflicts are between the herders and the farmers, competing over the scarce land and water resources, and among the crop growers over the irrigation water.

There is a strong link, between land and water degradation and shortage, water shortage and the livelihood conflict frequencies, in the Usangu plain. Thus the land and water scarcities, which are induced by the degradation of the resources, threaten human security through increased insecurity of the livelihood production activities. This is evident from the rainfall pattern, and change in the duration, which causes the low access to the clean and safe water, for domestic use, and water for the agricultural production activities, in the Usangu plain.

The policies that had played the major roles for the increased resources scarcities, and livelihoods conflicts, are those resulting into low quality of the land resource base, through encouraging agricultural practices that degraded the environment. Indirectly, policies for access to production technologies were not pro-poor, and not pro-sustainability of the environment. Furthermore, policies alienate the land from

the pastoral production activities, and neglected the traditional pastoral production system, in the development process.

5.2 Recommendations

There is need to minimize the land and water shortage and conflicts by reversing and/or improving the identified causes of insecurity in the rural livelihoods activities. The pertinent suggestions for the improvement are as follows:

- The link of conflicts to adaptive ways caused by low quality of the resource base, and aggravated by the further degradation of the land resource, calls for increased access of farmers to agricultural production technologies. This may include increased access to, knowledge and use of organic and in-organic fertilizers, efficient irrigation systems and improved adapted varieties of crops and a shift to the drought tolerant crops. The increase in production and profitability of the poor resources users should be via input subsidies; micro-finance institutions and long-term adequate investment plan for the agricultural research and extension. The increase in land productivity per unit area, and profitability has potential to decrease additional land space requirement. This would mitigate the land and irrigation water scarcities needed for livelihoods and would reduce conflicts over these resources.
- The influx of the cattle, into crop and irrigated fields, had increased herder versus farmer clashes, during the dry season. The increase in the influx is a result of the land alienation, from the pastoral production activities, in favour of the wildlife biodiversity conservation. The government needs to consider, adoption of participatory community based wildlife biodiversity conservation approach, which allows the wildlife-livestock co-existence, to create opportunity for the livelihoods of the pastoralists. The land and water resources sharing framework, for livelihoods of indigenous communities with the wildlife that are jointly agreed upon, implemented and monitored need to be developed for the eastern wetlands. This is possible as Lovett et al. (2001) found that, historically; in many places the cattle and the wildlife have co-existed for thousands of years, with little ecological problems.
- The rights and needs of access of the pastoral production activity, to fertile grazing land and water sources, have not been accepted by local leaders, and ignored by the authorities. The security of land rights, and access to pastoralists and agro-pastoralists is necessary for their livelihoods. This provides, a peaceful way to the government for solving their problems, arising from the nomadic and transhumance adaptive practices. Currently, the state owned rice farms, and the Usangu ranch, have been advertised, for the private entrepreneurs' takeover from the government. The takeover, of the private entrepreneurs, would add, another dimension of the resources conflicts, and may intensify the land and water use conflicts, in the Usangu plain. In order to reduce, farmer versus herder conflicts, and the land quality degradation, caused by the livestock confinement on the wet season grazing areas, surrendering part of these state owned land and water resources, in form of traditional grazing rangelands is proposed. These should be accompanied, and should integrate improvement, education, and sustainable traditional rangeland use planning and animal health services. This could form an entry point, for transformation of the subsistence traditional pastoral production into a sustainable commercial production.

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