ASSESSING COMMUNITY AND RESOURCE CONDITIONS: A Participatory Diagnosis Report for the Baga Watershed Lushoto Tanzania;

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EXECUTIVE SUMMARY

In September-October 2006 a multidisciplinary team of researchers from the AHI Benchmarksite in Lushoto, the Agricultural Research Institute (ARI) – Selian in Arusha, the Agricultural Research Institute (ARI) – Mlingano, Tanga, the Association for Land use Environmental care Research and Technology Transfer (ALERT) in Tanga, the Tanzania Forest Research Institute (TAFORI) in Lushoto and the extension personnel from the District Council of Lushoto conducted a focused participatory resource diagnosis (PD) study in the villages of Mbelei, Kwekitui, Kwadoe, Kwehangala, Dule and Kwalei in Lushoto district. The six villages are what this document collectively refers to as the Baga Watershed. The objective of the study was to assess resource conditions and their management. Special bias was taken towards water and soil related resources and their management because these formed the foundations for the project for which this PD was conducted. The diagnosis was conducted in a participatory manner in which the study team combined use of a modified approach called PLAR (Participatory Learning and Action Research) and the AHI method Guide to engage the study communities, discussed with them resource conditions, their causes and proper action to be taken. The activity was also continuation of engagements which the AHI has been undertaking in the area for the last 3 years now.

Results indicate that there is still significant degradation of water, tree and soil based resources in the Watershed villages. Water related resources like water streams, rivers, springs and wells are highly degraded and less productive than what they used to be 10-20 years ago. Many of the once permanent streams no longer produce water during the non-rainy months. In many of these villages water availability for irrigation is now a major source of social conflicts. Many farmers still report a declining trend in rainfall availability and its distribution within the seasons. Similarly yields per unit area for nearly all crops are falling with time. At the farm level the team observed significant soil erosion, lack of soil conservation practices, poor agricultural practices and falling soil fertility. Irrigated agriculture for vegetable and other horticultural produce is highly popular especially among the youth who have smaller landholdings as compared to their older fathers. The youth are practicing improved soil fertility management practices like fertilizer use in their fields which carry horticultural produce. Most of the important crops like coffee and banana which used to be irrigated during abundance of water are now practically rainfed and their actual acreage are declining. Many farmers point an acusing finger towards reduced precipitation as the reason for all the ills. Our team however, again confirmed four factors which contribute to the current water related conflicts and falling productivity from the fields; reduced amount of water from current water sources, increased water demand, excessive wastage of water through wasteful irrigation furrows and practices as well as poor distribution of irrigation water. To counter this trend in resource degradation our team discussed with farmers about the probable reasons for resource degradation and what could be done against it. The six villages have agreed to take actions that will progressively reverse the degradation of the water resources through collective action. They have in turn requested the project team to build their capacity in the utilization of efficient water utilization technologies and

related practices

1.0 INTRODUCTION

In August 2006, the AHI Benchmark site office was awarded a grant from ASARECA for promotion of Watershed work in Baga Lushoto. The grant project FP_06-AHI_RC01_SARI-(a) for the project titled "Promoting integrated NRM in Baga watershed, Lushoto, Tanzania was to be implemented in the Baga Watershed in Lushoto. The term Baga Watershed collects together six villages (Kwalei, Kwekitui, Mbelei, Kwadoe, Kwehangala and Dule) which all share a common drain through river Baga (Meliyo et al 2004, Mowo 2004). The grant was addressing two areas of activity; there was reclamation of the degraded land resources as well as research in the impact of selected tree resources in the livelihood of the communities in the Watershed.

Among the major activities planned before the major part of implementation for this project got underway was to conduct a focused Participatory Diagnosis (PD). The PD was planned to supersede others so as to allow the project team obtain baseline picture on resource and household conditions before the project has intervened. This was important considering that the project was bringing more collaborators in the scene than was previously done by the AHI itself through its own programmes. It was also felt that despite earlier works by the AHI in the area (Meliyo et al 2004, Wickama and Mbaga-In press, German et al 2006a, Wickama and mowo 2001, Lyamchai et al 1998); a most recent assessment of the natural resource base and the communities utilizing them was overdue.

This PD is also among the verifiable indicators for the ASARECA project mentioned above. As the ASARECA project aims at disseminating a number of technologies it was therefore believed important that before those technologies are disseminated and or demonstrated to the communities in the Watershed, the project team should make a visit to the target communities to assess if there were any situations that would support of threat adoption of the technologies so as to deveise the best approaches for their dissemination.

Four institutions came together to conduct this diagnosis. The team members came from the Agricultural Research Institute (ARI)-Selian in Arusha, the Agricultural Research Institute (ARI)-Mlingano, Tanga, the Association for Land-use Environmental care Research and Technology Transfer (ALERT) an NGO based in Tanga, the Tanzania Forest Research Institute (TAFORI) of Lushoto.

This study was therefore done with the following specific objectives:

1. Assess resource conditions in the Watershed
2. Assess community efforts in reducing the identified degradation
3. Identify areas for which project interventions will be necessary

2.0 HOW THE STUDY WAS CONDUCTED

The study area

The villages making up the Baga Watershed are some 20-30 kilometers east of the township of Lushoto. The six villages are at an altitude of 1100 - 1300 meters above sea level respectively. Ethnically, these villages are basically inhabited by the Wasambaa (80%), Wambugu (5%) and the rest being mixture of many other tribes. An earlier study by Meliyo *et al* (2004) locates the Baga watershed between Latitude 435114.25E, 9459812.53N (South); 437824.23E, and 9470004.90N (North) south of the Equator, and between longitude 441477.08E, 9467825.03N (East) and 430813.39E, 9465939.74N (West) East of Great Meridian. Administratively, the Baga Watershed is largely in Mamba ward, Soni division, in Lushoto district. Most of the watershed is within an area which Pfeifer (1990) describes as in the "*humid-warm"* agro-ecological zone with altitude ranges from 800 to 1500 m a.s.l. This zone receives an annual rainfall that ranges between 800 and 1700 mm. The major cash crops grown in the zone include coffee, tea and vegetables while for food crops maize, banana, potatoes, cassava and beans predominate. Earlier work by Meliyo et al (2000) in Kwalei village had indicated that most of the soils in the area are highly weathered, humic and ferralitic. Most soils classified into *Acrisols*, *Lixisols*, and rarely *Luvisols*, *on the hilland while Gleysols* and *Fluvisols* were mostly observed in the valleys. The six villages making up the Baga Watershed have a total area of 6006 ha; Kwalei (1098 ha), Mbelei (838 ha), Kwadoe (1217 ha) and Kwekitui (877 ha) Kwehangala (2277 ha) and Dule (301 ha).

Conduction of the study and the tools used

This was not the first time the AHI team would meet communities in the Baga Watershed for assessment of resource conditions. Bearing this in mind therefore the team undertook significant modifications in its former approaches so as to minimize time spent with farmers on same questions which had been asked by previous studies. For conduction of field work, our team apart from using the standard AHI methods of participatory engagements (German and Mekonnen (2006), Mowo (2006),) also modified and used a framework called PLAR – Defoer and Hilhorst (1995) (Participatory Learning and Action and Research) to identify community problems, their causes and their potential solutions.

Selection of these tools for the purpose was based on the experience of the team that the approach has been tested by the Agricultural Research Institutes (ARI) of Mlingano and Selian in Tanzania and was found to be effective for the purpose. The tool generally composes of community meetings, group discussions, resource inspections, action planning etc. In addition, the team frequently met with resourceful farmers who are knowledgeable in matters of interest to the team and who could represent the various interest groups across the villages.

The process

We therefore conducted this study through the following steps;

1. At first the project team met and drew a checklist of the issues which the project wanted to learn from the Watershed and its communities

2. Literature review was done from earlier works in the Watershed to assess which data needed fresh collection and which was already available, or which one needed to be verified if it has changed over the time

3. Then the team met, developed a new checklist of the issues it had to collect from farmers and individual households in the Watershed and prepared a Kiswahili based questionnaire to address them. A field officer pre-tested the questionnaire with a sample of twelve farmers (Watershed in each village) and fed back the team on the necessary adjustments

4. The team then sent messages to the respective village leaderships requesting for meeting with farmers. Each leadership was requested to select a small number of resourceful farmers who could discuss with the researchers wide ranging matters of the villages in detail. These would be apart from the open meetings with the larger audiences of farmers.

5. The team met farmers in pre-arranged places and times. During meetings the team was introduced to farmers and role of each team member was described. Farmers also introduced themselves detailing where they come from the villages.

6. The discussions were free but keeping close to the checklist of issues to be discussed. Farmers had dialogue on matters which they disagreed at first until when consensus was reached.

7. After the discussions, the team and farmers left for the field to visit water sources, crop fields.

8. For agro-ecosystem analysis, the project team took stock and assessed current degradation status of all water resources through actual field visits. Farmers' criteria and perception on the nature, type and extent of degradation was used to rank and categorise resources conditions and cultural practices based on the seriousness of their degradation status.

9. For vegetative resources, farmers were encouraged to identify them using their local vernacular languages. The team later on compared notes with Foresters at the Tanzania Forest Research Institute (TAFORI) in Lushoto, Tanga for the equivalent in scientific names

Conduction of household surveys and sample sizes:

10. Baseline data from household survey was collected in Watershed phases. Phase one composed of semi structured interviews, focussed group discussions, village transects, resource inspections and participatory mapping. The second phase focussed on households through the use of structured questionnaires which were developed in Kiswahili

11. Each village gave 20 households that were interviewed. This made the sample size to be 120 for the study area. Respondents were selected through a stratified random selection technique in order to have representation of different categories of stakeholders, social groupings and households represented. The data was summarised, coded and categorised accordingly. Chi-square techniques were used to determine if significant differences existed between the various categories of respondents

3.0 MAJOR OBSERVATIONS

3.1 Resource conditions in the Watershed

Socio-economic resources

The socio-economic conditions in the villages making up the Baga Watershed can not be fully explained without mentioning that there is some inter-dependence between them through the river Baga which flows through them. Along this river there is a vibrant vegetable growing industry. This industry thrives in the valley bottoms which Meliyo et al (2004) reported as covering only 5% of the landscape in the Watershed.

These valley bottoms however are responsible for 80% of the agricultural income for most households in the Watershed. In practice many households have a plot in the valley bottoms on which to cultivate vegetables like tomatoes and cabbages for sale. Socially, the six villages share similar ethnicity, customs and social values. The populations in each of the villages was reported by Meliyo et al (2004) to be as presented in Table 1.

Table 1: Population in the study villages in the Baga watershed

Village	Male	Female
Kwekitui	1414	1178
Mbelei	1111	1214
Kwadoe	1117	1377
Kwalei	1293	1434
Kwehangala	1169	1434
Dule	659	738
Total	**6763**	**7375**

Source: Meliyo et al (2004)

Across the villages a household (kaya in Kiswahili) is any family unit with a husband, wife and children or one of the parents with children. In the seventies an average

household had ten (10) members including either both parents or one of them.

The household size has decreased to an average of 5-7 members in the 90's due to: (a) Increased awareness on the dangers of big households and the high cost of education for the children (b) high cost of feeding the family (c) Lack of adequate land for the childrens future families (d) High cost for health care. When our team looked at household specific features like education of the household head, age and related parameters not many differences could be observed among respondents (Table 2).

Table 2. Selected characteristics of households in the target villages

Characteristic/village	Kwekitui	Kwehangala	Mean
Age of HH head (yrs)	44.4	46.3	46.8
Education (yrs in school)	7.6	6.4	7.0
Males/HH	2.4	2.8	2.6
Females/HH	2.9	3.4	3.2
Land holding per household (acres)	2.8	2.2	2.5

Source: Field data (2006)

This could be attributed to the fact that the six villages enjoy uniform socio-cultural background. Therefore the few differences observed among community members in this regard could be attributed either to chance or to factor other than those studied by this team. We also noted that a household in Kwekitui has fewer female members than at Kwehangala village, while its household leader has slightly better education exposure than his counterpart in Kwehangala. This could be attributed to the proximity of Kwekitui to a Missionary school at Sakhrani and Mbelei village (3 km away) than was the case for Kwehangala (9 km away). Generally in all the villages there are more females per household than males. A similar trend was reported in the last national census of year 2002 (URT, 2002).

At household level the survey found out that most families in the Watershed have small land holdings. Some are small to the extent that meaningful agricultural production is difficult. An interesting observation here is that for instance though at Kwekitui village families tend to have larger fields than say at Kwehangala or Kwalei and the other villages, these fields are more eroded and degraded than those at Kwehangala. This could be attributed to the fact that as Kwekitui village is barer it would be in a position to receive more erosive run off across the fields than Kwehangala or any other village which still has more trees on the landscape.

Land holdings

In the discussion with resource farmers, we learned that when the first Sambaa people moved into the Watershed before the sixteenth century they opened or cleared up as much land as they wanted. These people settled down and started farming. The acreage for their farms depended on how much land one could clear up at that time. The average household acreage in the 70's was 5 acres.

At the moment the average household acreage is 1.5 acres due to land fragmentation for new households. This land is not adequeate for many households. For this reason many

households (75-80%) have other farming areas outside their villages. The average household acreage outside the village varies from 1-3 acres. The majority of the respondents reported that 90% of the land in the Watershed is inherited from ancestors within a clan. The remaining 10% is acquired through buying from other individuals. The family labour provides about 80 - 90% of the household labour requirements in the Watershed villages. The rest (10 - 20%) is hired. Other hired labour can be obtained from outside the villages like for sawing trees and attending some of the field activities in the distant fields.We found a close relationship between age of household leaders and size of land holdings.

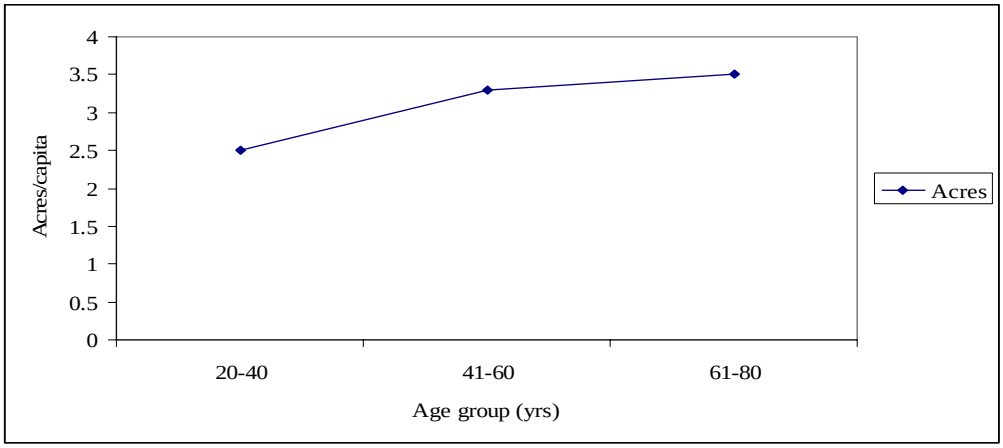

Figure 1. Distribution of landholdings per age groups in Baga Watershed

Older people in all the six villages were found to have larger farms than younger farmers (Figure 1). We believe this could be attributed to the fact that older people generally inherited larger pieces of land from the father-to-son arrangement, which is traditional among the Sambaa people compared to the present-day young people who are basically inheriting smaller and more fragmented land. Paradoxically despite their smaller landholdings the young farmers, tend to concentrate more in vegetable growing due to its higher returns per unit area. In fact most of the younger farmers who own small areas tend to solicit technical advice from the extension agents more often and are more diversified in their production and enterprise development than their fathers who own bigger chunks of land.

Figure 2. Young farmers in Baga Watershed tend to concentrate cultivating vegetables and fruits

Despite this variation in soliciting technical advice among old farmers versus young farmers, most of farmers in the Watershed still depend on agriculture since it is the major source of income and livelihood for all households. For example, in Mbelei village, agricultural enterprises account for 55-75% of the income for an avaerage household (Figure 3).

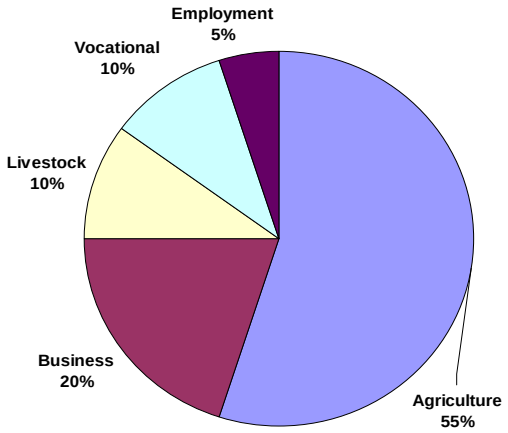

Figure 3. Household enterprises and their relative contribution to familiy income in Mbelei village

This trend is similar in most of the other villages. The figure gets lower (55-75%) in those villages whose farmers have access to off-farm employment like in Mbelei and Dule (trade, as they are junctions), Kwalei and Kwehangala (employment in tea estates). The margin is higher (75-90%) in those villages without such opportunities (Kwadoe and Kwekitui).

NRM-based institutions

An analysis done through a sister ASARECA grant (Mansoor et al 2006) found that there are largely two categories of institutions which operate in the Baga Watershed (Table 3). Going by the categorisation of Mansoor et.al (2006) we find that in Baga there are there are more external originated institutions that operate in the Watershed in matters related to Natural Resource Management than are internal originated institutions. This implies that for effective implementation of the NRM agenda in the Watershed care must be taken either to collaborate with those externally based institutions which operate same agenda in the villages or collaborate with an effective local institution which command considerable membership and authority

Table 3: List of Institutions influencing Natural Resources Management in Baga Watershed

Institution	**Category**	
Type	**Local**	**External**
Research institutions		ARI-Selian, ARI-Mlingano, TACRI, TAFORI, SUA, Pangani Water Basin Development Authority, TRIT
Network and programmes		TSBF, CIAT, AHI
Central Government Ministries		Natural Resources and Tourism, Agriculture Food Security and Cooperatives, Local Governments, Environmental, Community Development, Infrastructures, Livestock, Water
Local Government Authorities	Village and WARD Executive Officers (VEO & WEO), Division Executive Officer (DEO), Councilors, Village and Ward Governments, Members of Parliament	District Commissioner, District Executive Director, District Agricultural and Livestock Office, District Natural Resources Office, Councilors, Members of Parliament
Community Based Organizations	SACCOS, KIHATA, VIKOBA	
NGOs		TIP, LISHE TRUST, CHAMAVITA, TATEDO, MVIWATA, EEDI, FRIENDS OF USAMBARA
Private Agric-business	Herkulu tea estate, Kwehangala tea estate, input stockiest	
Traditional leaders	Respect /Popular people in the community	
Recreation	Cultural groups, Sports team	
Production groups	Dairy farmers, crop farmers	
Schools	Primary and Secondary	
Religious	BAKWATA, Sakarani farm, Lutheran, Baptist, Catholic	

Source: Mansoor et al (2006)

LEGEND

TRIT = Tea Research Institute of Tanzania

AHI = African Highland Initiatives

CHAMAVITA = Chama Cha Maendeleo Vijijini Tanga
EEDI = Environ. Enterp. Development Initiative
SUA = Sokoine University of Agriculture
TIP = Traditional Irrigation Program
TACRI= Tanzania Coffee Research Institute
TAFORI= Tanzania Forestry Research Institute

Crop resources

In all the villages, the area around the households can have a mixture of nearly twenty crops and fruits. The major crops though are maize, beans, bananas and coffee. In Kwalei village farmers reported that in the 1960's banana production was very high due to good soil fertility and adequate amounts of rainfall. This has fallen over the years due to falling soil fertility. However when we inspected the fields it was evident that poor agricultural practices were contributing much to the reduced production than was the soils or rain distribution. Very few farmers observe the limit of how many sucker should be allowed on a banana stand. Some stands (locally called *mgunda*) had as many as 15 - 20 suckers against the 3 advocated by extension agents. Manuring of these fields is seldomly done. The farming systems in the six villages is predominantly intensive mixed farming for both food and cash income purposes. Household farm size is fairly small ranging between 0.4- 1.0 acre. Due to land shortage all crops produced near homegardens are intercropped. Crops grown in the six villages include maize, beans, coffee, banana, cocoyams, sweet potatoes, yams, maize and vegetables. These crops are all intercropped. Farmers rank crops differently and allocate land to each category differently. The general picture was in the order maize>bean>banana >coffee. Vegetables normally occupy a total area of about 15-20% of total land available to the household and are in the valley bottoms. Fruit trees (include guavas, lemons, *percia Americana*, peaches and pears occupy about 10% of the homegardens. Residential area which includes area under livestocksheds, storage structures and residential houses occupy about 15% of the land area. Many houses are clustered together forming one household. The average picture of allocation of land to various crops is presented in Figure 4.

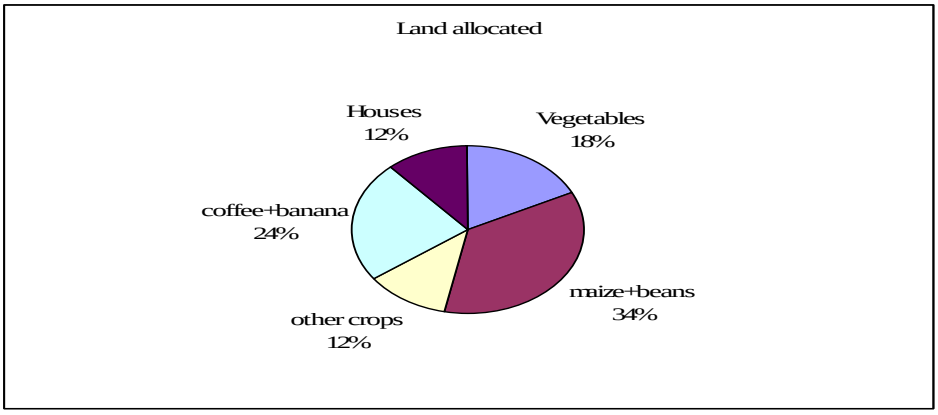

Figure 4. Allocation of land to crops and other purposes across the Watershed villages

Farmers' testimonies show that banana used to be the most important traditional food crop in these villages. It is only recent when most of the farmers have changed their eating habits accepting maize as another important food crop in their households. Currently, maize ranks first as a food crop followed by banana while beans rank third in importance. Similar results were also observed by Lyamchai et al (1998) in Kwalei village.

C***rop yields***

We observed that for most part many farmers in the Watershed do not practice proper cultural practices. For example across the six villages, proper soil conservation is practiced by only 20-25% of farmers. During harvesting, farmers ferry all crop residues to feed livestock. Virtually nothing is returned in the fields which produce these food crops. According to farmers, their grand fathers used to incorporate a local shrub called "tughutu" (*Venonia subligera*) into the soil for improving soil fertility. This practice has literally disappeared across the Usambara Highlands though Wickama and Mowo (2001) tried to revive it in Kwalei village. There are few farmers in Kwalei who still use tughutu for fertilizing tomato plots in Kwalei village. It can be said that the non addition of nutrients in the cultivated lands have contributed to rapid depletion of mineral nutrient elements in their soils and hence declining soil fertility. Trends in the yields of the major crops in Baga Watershed over the last 40 years are presented below.

Table 4. Crop production trends in Baga Watershed between 1960 - 2000

Crop/Year	Period and yield per acre				
	1960's	1970's	1980's	1990's	1999
Maize (90 kgs bags/acre)	5-15	15-20	15-20	8-10	10-12
Beans (90 kgs bags/acre)	1-3	1	3	2	3
Coffee (50kgs bag/acre)	20-25+	5-10+	3-4+	1-2+	1+
Bananas (Bunches per acre)	150	75	150	75	90+

The general trend from this Table is that of declining yields per unit area over this time period. Yields of maize for example have lately ranged between 700-900 kg per acre compared to 1000-1800 kg/acre in the 1970's and 1980's. Bean yields have also remained low and static (180-270 kg/acre) during the past 18 years. In Kwekitui village farmers attributed the declining yields to declining rainfall amounts and distribution, declining soil fertility, lack of improved varieties, insect pests and high costs of fertilizers. Low soil fertility is caused by various improper farming practices, such as lack of soil conservation measures, limited use of fertilizers and poor soil management techniques. Despite the fact that use of mineral fertilizers especially

nitrogenous ones is strongly recommended for maize production, however, this package has not been widely adopted because of the high prices for fertilizers and generally low awareness in fertilizer use. Application of farm yard manure (FYM) has equally been low in the maize fields as most armers prefer to use it in banana fields and vegetable gardens than maize. In fact we encountered strong application of nutrients in the form of inorganic fertilizers, kraal manure and compost in the tomato gardens in the valley bottoms. Thus suggesting the application and application for some farmers was only economically motivated. As for coffee, most farmers began cultivating it in the early 1940's. According to them, significant coffee production occurred in the 1950's - 60's. They attribute the highest production on training of farmers by the then colonial village extension workers in proper coffee husbandry and timely delivery of inputs. At that time the inputs were provided on loan by the Usambara Cooperative Union. This arrangement collapsed and it only now that some efforts of reviving it are being discussed. Peak coffee production is recalled to have been obtained in the 1970's. Production of coffee started to decline in the 1980's due to combined factors such low prices offered to farmers, depreciation of the local currency (shilling) which pushed prices of inputs, removal of subsidy on inputs by the Government which made the inputs cost more, old age of the coffee trees, low soil fertility, reduced precipitation, coffee insect pests and diseases and worldwide increase in coffee production which forced a downward turn of coffee prices in the world market. These factors have contributed to reduced morale of farmers to produce coffee such that at present farmers are harvesting very low yields; A farmer in Dule village reported harvesting 50 kgs/acre of parched coffee instead of 250 - 750 kgs/acre in the 1970's.

Food availability

During the household surveys, data from all the six villages indicated that adequate food is available during the months of July, August, September, October and November. This period concides with harvesting of annual crops planted during the long rains. These crops include maize, beans and banana. Food shortage is slightly experienced during the months of December and January and again improves in February and March after the harvest of short rains maize and beans. Food security status is worst in May and June. Only 40% of the respondents indicated they harvest adequate food for a year round sustenance without experiencing any sort of inadequacy. Seasonal food availability is depicted in the Figure 5.

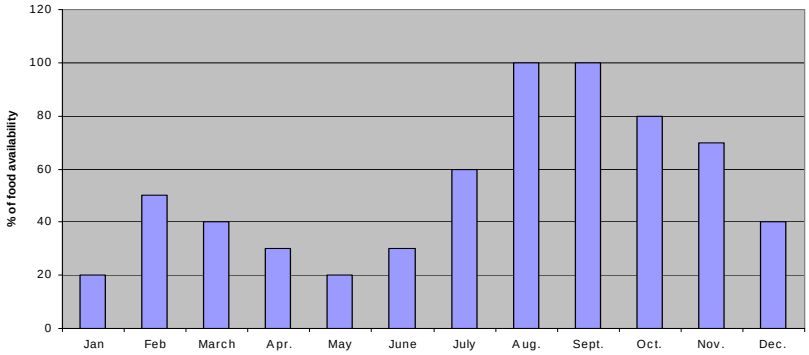

Figure 5. Trend in food availability across the year in Kwehangala village

Livestock resources

Many farmers in both Baga watershed village reported that there are fewer livestock numbers today per household than used to be the case 30-40 years ago. The blame is put on the increase in human population which resulted into land pressure that decreased the availability of grazing areas and with it, the livestock numbers. The elderly farmers in Kwadoe and Kwekitui village recalled that in the past, (before 1950's) livestock keepers in their village practiced extensive livestock production system whereby large animals grazed freely on the range. Over the years land has become scarce as a result of increasing human population. Currently farmers in these village practice mixed farming whereby crops are grown with a few animals normally stall fed. Livestock kept include cattle, sheep, goats, chicken, ducks, and rabbits. Most of the breeds kept are indigeneous with an exception of a few cross bred dairy cattle. Livestock keeping caters for different purposes including income, manure for soil fertility, milk and meat.

Table 5 : Number of Livestock across the Watershed villages

Livestock	**Kwalei**	**Kwadoe**	**Kwekitui**	**Kwehangala**	**Dule**	**Mbelei**
Cattle Indigenous	210	420	286	284	494	266
Cattle Exotic	292	210	40	196	273	188
Sheep	62	124	141	123	512	87
Goats	84	340	112	187	324	213
Chicken	843	1123	767	467	1465	654
Total	1,491	2,217	1,336	1,157	3,068	1,308

NB: Estimates at DALDOs Office Lushoto (2006)

Management activities are normally divided according to gender. Feeding, milking, and cleaning the animal sheds are women's roles. Men are responsible for health and breeding issues such as looking for veterinary services and good quality bulls whenever required. A drastic change in livestock populations occurred over the years as a result of the following factors:

(i) A decrease in grazing land due to land pressure resulting from high human population density
(ii) Chronic disease and parasite challenges due to lack of veterinary services
(iii) Frequent and prolonged droughts leading into shortages of feed
(iv) Decrease in trees and shrubs which provide supplemental feed in the

dry season

(v) Pressure to sell livestock as source of income to meet various costs such as health and education.

Table 6: Livestock Production trends in Baga Watershed

Species	Years						
	1940	1950	1960	1970	1980	1990	1999
Indigenous Cattle (TSZ)	+++++++ ++++	+++++++ ++	+++++++ +	+++++	++++	+++	++
Improved Cattle			+	++	+++	+++++	++++++
Goats	+++++++ +++	+++++++ +++	+++++++ +	++++++ +	+++++	++++	++
Sheep	+++++++ +	+++++++ +	++++++	+++++	++++	+++	++
Chickens	++	++	++	+++	++++	+++++	++++++
Pigs			+	++	+++	+++	++

Legend:
+++ - Increasing
+ - Decreasing

The reasons for keeping livestock have been changing with time. At present food, manure and income generation and are the most important criteria farmers base upon when purchasing or owning livestock. Manure availability has recently become as equally important a reason for keeping livestock as is food and income. This is due to a growing realization among farmers that soil fertility is declining and that kraal manure is important to ameliorate the situation.

Most animals in the Watershed are stall fed. Feeding is done twice per day in the mornings and evenings during milking. Banana pseudostems and bana leaves plus some grasses planted within the homes form the basal diets for animals. Planted pastures include *Tripsacum laxum*, (Guatemala grass), *Pennisetum purpureum* (Napier grass) and *Desmodium spp*. But these are only few. The majority collect grass from the neighboring forest or grow them.

During focus group discussions in Kwadoe and Kwalei, farmers explained that in general, livestock production is low due to a number of factors including, poor breeds, low purchasing power of farmers for inputs required for proper animal nutrition, lack of expertise on proper animal husbandry techniques and animal diseases and parasites. In the Watershed villages, the common livestock diseases for cattle, goats and sheep include; east coast fever, contagious bovine pleuro – pneumonia,

blackquarter, anthrax, mastitis, anaplasmosis, internal and external parasites, foot and mouth disease, haemorrhagic septicaemia. In poultry the commonest is new castle disease.

Soils, and Water resources

Across the six villages, there are prominent signs of soil erosion and other prominent signs of soil degradation. Among the six we noted more cases of eroded fields in Kwekitui village than the others. Yet there are more farmers with conserved fields in Kwalei, Kwehangala and Dule. The majority of the farmers in all the six villages report that soil erosion has increased in recent times than during the colonial era. The elderly among them could recall that in the 40's - 60's most land had not opened for agriculture. Also farmers were frequently mobilised and followed upon by colonial extension workers on erosion issues. After independence a big chunk of the forest land was opened up and given to farmers for cultivation. In the 60's - 70's farmers were no longer mobilized and advised on the importance of contour bunds despite the fact that the by-laws were still on. Hence the construction of the terraces contours started declining. The situation worsened from the 70's todate and nearly all of the contour structures have broken down and soil erosion and nutrient depletion have drastically increased. It's very unlikely to see any effective colonial contour structures in the Watershed villages now.

Figure 6. Soil erosion in one of the fields in Kwekitui village. Soil erosion control tructures in this field

have been neglected

Based on differences on topographical features, main farming systems components intensity, and natural resources, transect walk routes were identified for each village differently. The key informants were subdivided into sub-groups based on their familiarity and local knowledge of the routes. Each group was assigned a team of facilitators selected based on the main features of the sub-catchments. The observations made during the transect walk showed that soils in all the six villages were very similar. The soils were very deep, well drained and developed from gneiss and other related metamorphic rocks. The soils were mostsly ferralytic and highly weathered. Meliyo et al (2004) classified mosf these soils into the Lixisols and Acrisols for the Hilland while Fluvisols were located for the valley bottoms. According to Donahue *et al.* (1995) such soils once cultivated tend to have an unstable structure and are easily eroded unless measures for soil erosion control are taken into account. These soils which abound the Baga Watershed can not store soil moisture for long if exposed to prolonged drought conditions. It is therefore absolutely essential that productive use of these soils include proper soil management practices including those which conserve moisture. These measures are generally lacking in the Watershed villages.

As argued by Donahue *et al* (1995), the type of soils found in the Baga Watershed is the type which can easily lose fertility upon use if there are no restoration measures. This correlates well with farmers' claim in all the six villages that their fields were very fertile up to the 1940s. Infact during that time they used to get very good maize, beans coffee and banana yields because land was abundant and they could practice crop rotation/fallow. Farm yard manure was plenty due to large livestock population. But, following the building of land pressure in the 50's to 60's, the new set up necessitated keeping low numbers of livestock and hence low manure production. Fallow and crop rotation were no longer possible. When these developments are combined with the general practices of not fertilizing these soils after use, the decline in soil fertility is almost guaranteed.

During the group discussions, farmers in Kwekitui and Mbelei reported that soil fertility had declined drastically due to the following factors:

1. Villagers negligence of expert's advice and recommendations on proper soil and water conservation practices.
2. Lack of monitoring of conservation structures.
3. Lack of reinforcement of soil and water conservation by-laws by local government.
4 Lack of soil and water conservation structures in affected areas.
5. Rampant tree cutting without replacement. Most recall that lots of trees were cut in the period between1975-1990 in order to generate household cash income.
6. Improper cultivation and crop husbandry practices.

7. Inadequate amounts of farm yard manure and improper application of the available manure.
8. Soil erosion due to forest clearing
9. Drying up of water sources and streams leading to inadequate rainfall and water for irrigation.
10 Inadequate livestock feeds resulting into use of mulch and other groundcover materials for feeding livestock.

Tree-based resources

An outstanding feature in the Watershed villages is the remarkable and very attractive inclusion of trees in their fields. According to the elderly farmers of the Watershed villages, there were many indigenous trees in their homegardens and in fact around the villages in the 1940's - 50's than present. This is because the human population and environmental degradation at that time was still small. By the late 1960's - 70's the human population had increased such that new forest areas were cleared for settlement and farming. In doing so, trees were cut down for construction purposes. Around the 1980's, some farmers began selling their on-farm trees to timber makers and consequently the number of trees in the home gardens and the nearby forests began decreasing. Many farmers associate this decline in tree population to decreased precipitation in their area. A typical homestead is likely to have almost 50 different trees. Some of the most prominent include; *Mhafa, Miungu, Mkulo, (camphor), Mkuyu, Mmongko, Mshai, Mshihwi, Mtiindi, Muombeombe, Muula, Mvumo, Mweefu, Mweeti (Msesewe), Ng'weng'we.* Some of these trees and their technical names are presented in Appendix

Almost all farmers in the six villages reported that there has been massive reduction of the indigenous trees across the Watershed. They attribute the reduction to four major factors (a) indiscriminate felling of trees for expansion of agricultural land (b) population increase which adds pressure on the demand for land (c) increase in area allocated for human dwellings which has necessitated clearing of more land from the initial forests for that purpose (d) haphazard burning of fires in the forests.

During the discussions with the groups we came up with this trend which shows a gradual decline in the forest cover with time (Figure 7). The trees mostly cut down were *Albizia spp, Cordia Africana, Olea capensis* due to their high quality timber and fuelwood. Exotic trees such as *Grevillea spp, Cyprus* and *Eucalyptus spp* were introduced into the villages by the colonial rulers in the late 40's. The number of exotic trees increased gradually up to the 70's after which they started declining due to uncontrolled harvesting, lack of planting materials, weak follow-up of by-laws to protect the trees and unavailability of land to plant trees (land pressure).

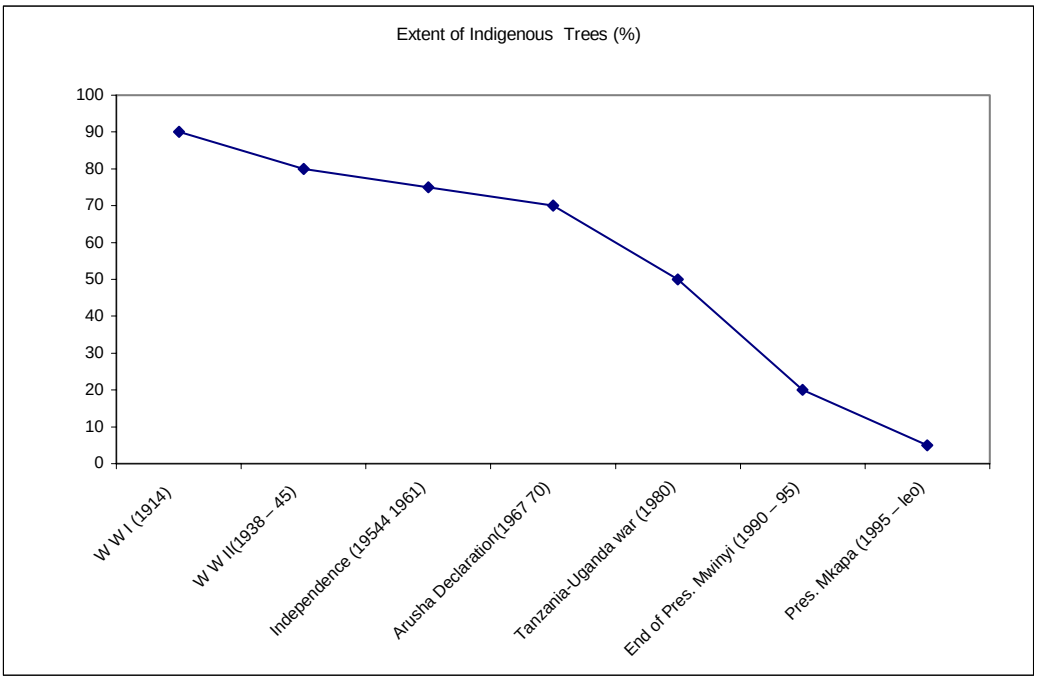

Figure 7. Trend in the decrease of indigenous trees in Baga Watershed in various periods

The rampant tree cutting without replacement has resulted into decreased rainfall, loss of soil fertility, low crop yields, high prices of building materials and less income for the households. Currently there are very few indigeneous trees such as *Albizia spp*; *Cordia africana*, *Cheorophora excelsa* and Olea *capensis* left in the homegardens. *Grevillea spp* is the most widely grown exotic tree spp whereas the *Eucalyptus spp* are less popular because farmers consider them as moisture drainers due to their ability to drain up water from very deep soil layers causing dry soil conditions where they grow.

It will be noted that though there has generally been a steady decline in the presence of indigenous trees in the villages, the period "Arusha declaration" onward has a steeper decline. This could partly be attributed to the implementation of socialist policies in the form of villagization schemes. In these schemes, people were moved and resettled in newer areas where they established "Ujamaa (socialist) villages. To settle in these places required space for agricultural land and materials with which to build the villages. Many farmers attribute this period to significant clearing of natural forests after the initial clearance, which was done shortly after independence.

Water-based resources

It is correct to say that the catchment that houses Baga Watershed is blessed with a big number of water sources. In this PD we counted not less than 140 sources across the six villages. However owing to the abuse of the natural resources, including the

water sources, a significant number have dried or become seasonal. During this study, the majority of farmers ranked inadequate availability of water as their problem number one. Farmers attribute the inadequacy of water to four major factors; *reduced amount of water from current sources, increased water demand, excessive wastage of water from poor water use practices and poor distribution of irrigation*. These factors are in-turn caused by several underlying causes (Fig 9).

Fig 8. Many farmers believe the Eucalyptus have depleted water in streams and wells

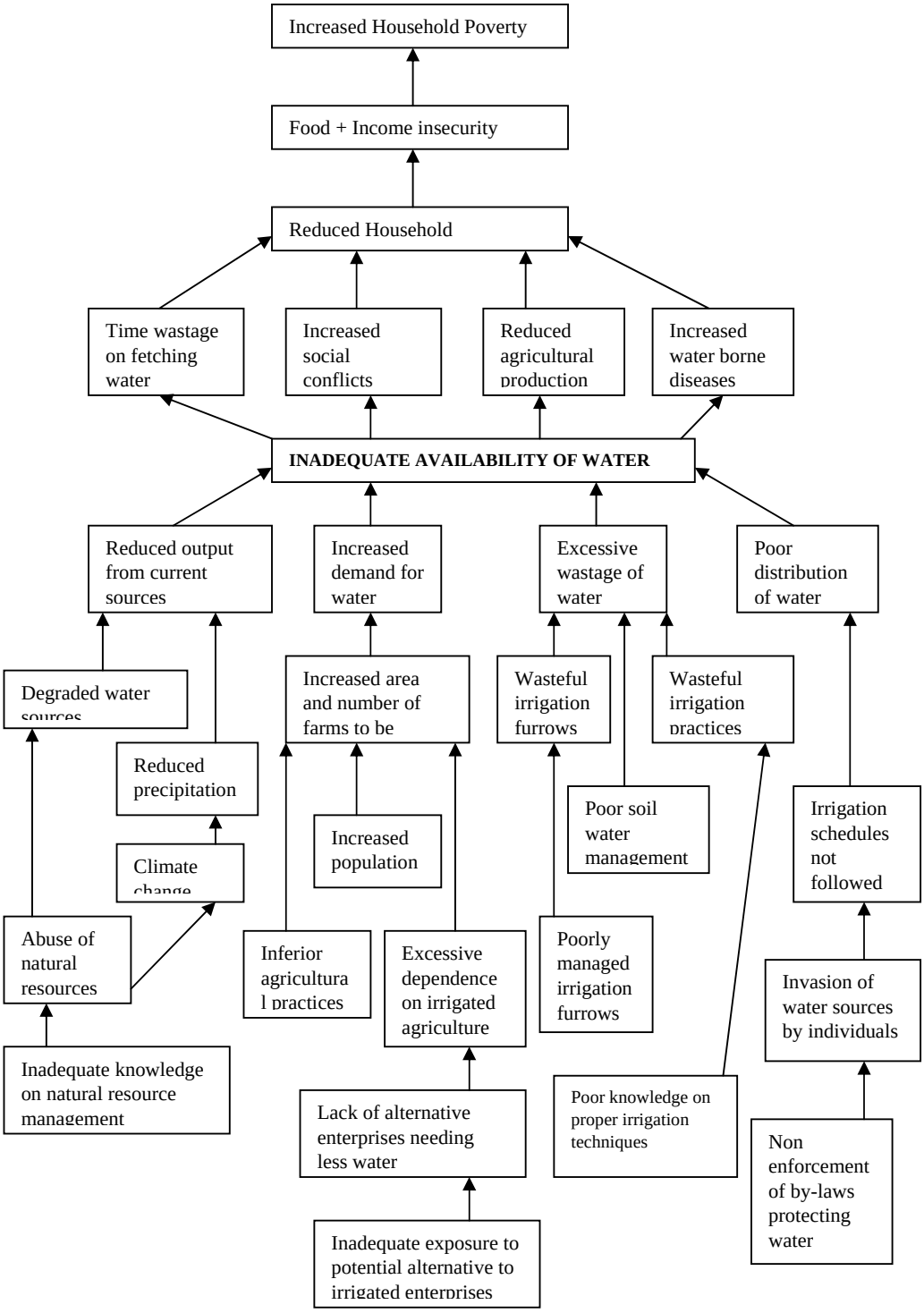

Figure 9: Schematic relationship between water availability and household poverty in Baga Watershed, Lushoto, Tanzania

Figure 10.Degradation of the water resources have seen unavailability of water across the Watershed growing

Historically, farmers report that inadequacy of water in the Watershed villages was unnoticed before the 1960s. The elderly farmers in Mbelei and Kwekitui villages reported that prior to the 1960s water was in ample supply and "you could not then see the river bottom due to thick forests at the time" Changes became noticeable after huge tracts of forested land was cleared and allocated to the local people for cultivation in the mid 1960s. Presently, the Watershed villages and indeed the whole catchment are observing decreased numbers and discharges of springs. Consequently a number of streams and rivers have become seasonal though were once permanent. Irrigated agriculture has now fallen and people degrade the fragile water sources though there are by laws which bar them from such practice.

Unlike any other period in the past, now the villages' governments in Baga watershed and the Sambaa elders handle water related conflicts than before. Women are exceptionally affected by this problem. In off-rain season they have to walk long distances to fetch water unlike in the past where each household virtually was served by an irrigation furrow. Perhaps to illustrate the magnitude of this problem, here is the example from Kwekitui village. In Kwekitui village farmers mentioned 9 water sources which used to provide the entire village with water. However the numbers of water sources which now reliably provide water across the year are only 4 (50%). Hence whenever the rain season ends in these villages, their governments brace themselves for the handling of water related conflicts.

3.2 Community efforts in reducing resource degradation

We have observed the communities in the Baga Watershed to be applying different techniques aimed at reducing resource degradation. Some of these efforts coincide with implementation of the AHI Research Protocol and Workplan for 2004-2006.
For example currently in Kwalei village farmers apply various strategies to minimize soil fertility decline in their gardens. These included

Application of farm yard manure in the vegetable, banana and coffee gardens: This development has come a long way. In the past many farmers did not like applying manure in either of the two. We noted that their complaints were associated with availability and transportation of the manure to the fields of these crops which are always on the hilland with the exception of the vegetable gardens. However repeated contact and encouragement from the AHI team has resulted into many of these farmers applying maure in these crops. Across the watershed these efforts are now showing fruits. Vegetable gardens now harvest more through use of both manure and inorganic fertilizers

Figure 11. In this photo the young farmers are seen with insecticide pumps in their tomato garden cultivated in the middle of an eucalyptus field in the valley bottoms in Kwehangala village

Figure 12. At long last the tomatoes are now harvested, packed and sent to Dar-es-Salaam market

Growing trees which improve soil fertility in their farms like tughutu (Venonia subligera) and applying them as green manure: The story of this famous shrub was first published by Wickama and Mowo (2001). The local people chop its leaves and place them in the planting hole of the crop of their choice. ARI Mlingano in Tanga, Tanzania did a number of verification trials to ascertain if its leaves were rich in nutrients as claimed by the local people. The Wasambaa had been using the shrub for soil fertility enrichment for many years. The verifications proved positive. Currently, there are many farmers especially in Kwalei village using this shrub as green manure. In the past it was being used to enrich maize and bean fields, this has now changed to the vegetable fields in the valley bottoms. This is one way in which the local people fight back decline in soil fertility.

Figure 13. This is “tughutu” one of the local green manure shrub in Kwalei village

Construction of conservation structures like terraces to reduce loss of soils from fields:

In year 2004 when the AHI team first visited Watershed villages, one pattern kept repeating itself; water sources had been seriously abused. In Kwekitui village water availability was such that women could spend 4-6 hours fetching one bucket of water. Across the six villages there is renewed sense of hope in restoring the water sources after the AHI team had initiated reclamation of degraded water sources across the Baga Watershed in 2005.Some 30 sources across the six villages were reclaimed. Most farmers reported that the reclaimed water sources had reduced time wasted to fetch water and the social conflicts

Because of these efforts we have found farmers doing the following;

1 Replanting indigenous trees perceived as being water friendly around the water sources in Kwalei and Kwadoe.
2 Taking action to those cultivating up to the water sources. A case from Kwalei village is in the district court of Lushoto over the matter
3 Farmers are requesting the AHI team to assist in construction around the water sources. They are collecting stones and sand themselves

Figure 14. Communities have started contributing stones and sand towards the construction of the water collection structures to reclaim water sources

4.0 Conclusions

(1) Though the practicing of poor resource management techniques by the Watershed communities has added to the problems, the steady growth in population has significantly contributed to the pressure on the Watershed resources and with it the ensuing abuse.

(2) There is still significant resource degradation in the villages of Baga watershed. The most visible forms are reduced cover from indigenous trees that are friendly to water sources, soil erosion, siltation of water dams and springs. The other forms of degradation are declining water sources and soil fertility in agricultural lands. Kwekitui village is the most degraded in terms of soil, water and tree resources.

(3) As observed in years 2004-2005 during the development and implementation of the research protocol for the AHI in Lushoto, most farmers in the Baga Watershed are still unaware of efficient irrigation practices which require less amount of water for similar effect. Therefore, while the water availability situation was less bad compared to years 2004-2005, the relief is possibly contributed by the good rains in year 2006 and the water source reclamation structures put up by the AHI team in Lushoto

(4) Despite little progress among farmers close to the AHI project team in the six villages, the bulk of farmers in the Watershed still practice resource inefficient methods in their production activities.
(5) Most farmers are not aware of other enterprises which could be undertaken that could bring in good income without depending on rainfed or irrigated agriculture.
(6) There is a growing awareness among village leaders that by laws that protect water sources must be enforced. More need to be done still especially in Kwekitui, Mbelei, and Kwalei villages.
(7) Adoption of the technologies targeted for dissemination by project FP_06-AHI_RC01_SARI-(a) in the Baga Watershed is still low. However there is sufficient reasons to believe that the technologies will benefit the targeted communities

5.0 Recommendations

We therefore recommend the following measures;

(1) Implement the agenda of project FP_06-AHI_RC01_SARI-(a) as had been planned
(2) Encourage enforcement of resource protection by laws across these villages. For this there is need of soliciting political and executive support from the local district council in Lushoto
(3) Strengthen the inter-village Watershed committee for following up on trans-boundary matters that relate to resources under investigation
(4) Expose farmers to superior resource efficient practices so as to bring around judicious utilization of natural resources in Baga

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7.0 APPENDICES

Appendix 1; Community perception on trends of selected components in the homesteads, fields and other land resources across the Watershed of Baga.

Period	1940-1950	1950-1960	1960-1970	1970-1980	1980-1990	2000+
	Rating (1-12)					
Number of people in the village	3	5	6	9	11	12
Availability of farming area	12	11	10	8	5	2
Soil conservation measures	11	12	8	4	2	1
Forest and Trees cover	12	11	9	7	4	2
Number of fruit trees per farm	12	9	8	6	4	3
Production of bananas	12	12	11	6	4	4
Production of coffee	10	12	12	6	7	2
Availability of animal fodder	12	12	10	7	4	2
Number of livestock	12	11	10	7	5	3
Fertility of the soils	10	10	8	6	4	3
Availability of rainfall and water	12	12	10	7	4	2
Use of animal manure in the fields	10	7	5	3	3	2
In-field mulch application	10	8	6	4	3	1
Proportion of crops sold for cash	1	3	4	5	6	6
Enforcing environmental by laws	10	9	5	2	1	1
Use of inorganic fertilizers					1	1

Source (Field Data 2006: based on discussions with farmers in Mbelei and Kwalei villages)

Note 1 = Least, 12 = Most

Appendix 2: Types of trees familiar to farmers in Baga Watershed

Cheo	**Asilia**	**Botanical names**	**Manufaa**
10	Mkuyu	*Ficus- Vallis chaudae*	Mbolea , Maji, kuni, dawa ya meno
9	Mvumo	*Ficus Sapensis*	Mbolea, maji, dawa ya moyo, Ng'ombe – maziwa
5	Mshihwi	*Syzygium gummifara*	Mbao, kuni
9.5	Muombeombe	*Hallea rubrastepulata*	Maji na dawa (Jino, kambaku)
10	Mshai	*Albizia gummifera*	Kurutubisha ardhi, kuni, mbao,dawa (meno)
8	Mtiindi	*Cusonia holstii*	Kurutubisha ardhi
6	Miungu	*Enythrina abyssinica*	Kurutubisha ardhi Dawa (Tumbo)
8	Mmongko	*Barsama abyasinica*	Kurutubisha ardhi, kuni
6	Muula	*Parinari excelsa*	Dawa, Mbao, Matunda yanaliwa
9	Mweeti (Msesewe)	*Rauvolfia caffra*	Dawa ya ng'ombe (minyoo) watu (Minyoo) Maji, mbolea
7	Ng'weng'we	*Dracaena usambarausis*	Kamba, majani ya ng'ombe maji
5	Mweefu	*Meaukusanywe*	Mbolea, Dawa ya meno na tambazi, mipini ya majembe
8	Mkulo (camphor)	*Ocotea usambareusis*	Mbao kuni
5	Mhafa	*Milletia dura*	Mbao
8	Mzingazinga/Mfufu	*Cordia abyssinica*	Mbolea Mbao
5	Mluwati	*Dombeya shupangae*	Dawa ya upele, kuni, majira ya kulima,
8	Mshegeshe	*Myrica salicifolia*	Dawa ya muku, kifua
7	Muuwi	*Synadenium glaucescens*	Dawa, sumu, maji, kuku kideri, (unatoa ngozi)
10	Mzumbasha	*Ocimum suave*	Mbolea, Dawa ya malaria, kiungo cha chai, dawa ya kukohoa
10	Mmandai		Mkaa, kuni, dawa, sumu, inatibu kuteguka

Appendix 3. Suugestions put forward by farmers on how to overcome some agro-ecological constraints in Baga Watershed

Crop	Constraint	Strategy
Coffee	Low coffee price	- Minimize coffee marketing overheads - Produce alternative crops e.g tomatoes and cabbages
	Aged trees	- Plant new trees - Replace old trees through stumping
	Drought	- Plant shade trees e.g *Albizia spp*, *Cordia africana* & *Croton n macrostachys* - Mulching - Construct trenches to capture and conserve water within farms - Rehabilitation of traditional canals
	Lack of capital	- Reinstate credits for inputs - Form farmers groups for inputs
	Lack of inputs	- Apply for agric. inputs trust fund
	Pests and diseases	- Timely pesticides treatment including indigenous practices e.g Urine/salt/kerosine mixture
	Low soil fertility	- Promote use of farm yard manure
	Low yields	- Use of improved varieties
	Low soil fertility	- Promote use of farm yard manure - Grow trees - Encourage livestock keeping - Train people on how to prepare and use compost
	Pests	- Frequent desuckering - Use varieties resistant to weevils - Proper land preparation
	Drought	- Mulching - Construction of trenches to conserve water - Rehabilitation of traditional irrigation channels
	Inadequate desuckering	- Strengthen the extension services
	Low yields	- Promote timely and correct desuckering - To plant new banana suckers - Use of improved cultivars
Maize	Low soil fertility	- Promote use of fertilizer

	Pests and diseases	- Use of pesticides - Use of improved varieties
	Lack of improved varieties	- Use of improved varieties
	Low yields	- Use of improved varieties - Improve crop management - Use of fertilizers
Beans	Lack of improved varieties	- Use of improved varieties
	Pests and diseases	- Use of pesticides
	Low yields	- Use of improved varieties

Appendix 4 . The Kiswahili Questionnaire used for data collection during Household Survey

DODOSO LA UTAFITI WA UTUNZAJI WA RASLIMALI; MAJI NA ARDHI

A. MAELEZO BINAFSI
Tarehe_____

Jina la kijiji_____ Tarafa_____ Kata_____

Jina la mkulima_____ Umri_____
Jinsia_____

Elimu_____ Idadi ya wanakaya_____
Ke_____,Me_____

B. UHARIBIFU WA RASLIMALI NA JAMII

1 Ni uharibifu gani wa raslimali uliopo kijijini kwa wingi?

Raslimali	Uharibifu

2 Ni vyanzo vipi vya maji vilivyoharibika zaidi kutokana na matumizi mabaya?

Vyanzo	Kilipo

3 Eleza kwa kifupi historia ya uharibifu wa vyanzo vya maji hapa kijijini .

4 Taja aina ya uharibifu na athari zilizovikumba vyanzo husika.

5 Ni juhudi zipi zinafanyika kupambana na athari ya uharibifu wa vyanzo vya maji?

Juhudi	Wapi ili/nafanyika

6 Nani washiriki wakuu wa jitihada za kupambana na uharibifu wa raslimali husika

Washiriki	Uharibifu

C. MAPAMBANO DHIDI YA UHARIBIFU WA VYANZO VYA MAJI NA ARDHI

1. Njia gani zinazotumika kuhifadhi raslimali dhidi ya uharibifu hapa kijijini?

Raslimali	Njia

2. Kaya inapata wapi maji ya kutumia kwa ajili ya;

Kilimo	Nyumbani

3. Ni hatua gani zinazotumika kuzuia uharibifu wa vyanzo vya maji vinavyotumiwa na kaya?

Chanzo	Hatua

4. Njia gani za umwagiliaji zinatumika katika mashamba hapa kijijini?

Njia	Mashamba (mazao)

5. Njia hizi zinakumbwa na matatizo gani?

Njia	Matatizo

6. Kaya inapambana vipi na ukosefu wa maji/unyevu wa kutosha shambani?
…….

7. Kaya inapambana vipi na ukosefu wa maji nyumbani?

…….

D. MATUMIZI MBADALA YA MAJI NA ARDHI

1. Kuna vyanzo vingapi vya maji hapa kijijini?

Chanzo	Mahali kilipo

2. Vyanzo hivyo vinatumika katika vitongoji gani zaidi ?

Chanzo	Kitongoji	Matumizi

3. Ni shughuli zipi mbadala hapa kijijini/kaya ambazo hazitegemei maji na ambazo zinaweza kuendelezwa?

…….

4..Ili shughuli hizo zifanyike kwa tija zaidi kunahitajika nini?

……

5a. Jitihada gani zinatumika kuboresha shughuli hizo?

……

5b. Ni watu gani katika jamii wanaozifanya shughuli hizo zisizohitaji maji hapa kijijini?

Wahusika	Shughuli

E. MAZAO NA MASOKO

1. Mazao gani yanayolimwa katika eneo lako?

…….

2.Ni mazao gani ambayo hulimwa sana kuliko mengine?

…….

3.Mazao hayo yanauziwa wapi?
……..
4.Kuna matatizo gani yanayohusu soko kwa mazao hayo?
……

5a. Ni wakati gani bei ya mazao yaliyotajwa hapo juu huwa nzuri?
……

5b. Je miradi mbadala isiyotegemea maji inapata wapi soko?
……..

F. SHERIA NA SERA

1. Je, kuna sheria zozote zinazozuia uharibifu wa vyanzo vya maji?

Ndiyo ……

Hapana ……

2.Sheria hizo zinatekelezwa vipi hapa kijijini?

Sheria	Utekelezaji

3. Utekelezaji wa sheria hizo una athari gani kwa wanakijiji na raslimali husika?

Sheria	Athari

4. Utekelezaji wa sheria hizo unawanufaisha vipi wanakijiji?
……

5.Serikali imechukua hatua zipi dhidi ya uharibifu wa raslimali husika?

6. Ili sheria za uzuiaji wa uharibifu wa raslimali zitekelezwe kikamilifu,kipi kifanyike?

……..