Research Report

Termites in Mana-Sibu District of Oromiya

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Introduction

West Wellega Zone, being suffering from termite infestation, is among the major coffee growing zone of Oromiya Region. The damage caused by this insect is characterized by serious land degradation affecting both crop and livestock production. Termite affected over 600,000 hectares in the Zone to the extent that the farmers have been forced to abandon their residence area, which is a remarkable crisis for the resource poor farmers of the area (Girma et al., 1999; ICRA, 1998).

Among the districts found in West Wellega Zone, Mana-Sibu is one of the most termite-affected districts (Girma et al., 1999). Though termites are important constraints in this area, they have not been given due emphasis except termite mound poisoning and a few management practices as afforestation and area closure of termite-infested fields practiced by the Mana-sibu Environmental Rehabilitation Project (MERP). However, these practices have not been ultimate solutions to the problem. This was partly because termite control options should have been integrated in the form of system approach.

This publication reports a survey conducted to investigate the termite situation of Mana-sibu district emphasizing to uncovered areas by previous works with the following objectives:

- characterize and identify farming system, problems and options of Mana-Sibu district, and suggest research, development and policy prescriptions concerning termite problems;
- investigate the cause, extent of damage, and consequences of termite; and
- create awareness in the farming community, government and non-governmental organization how to manage termite problems of the area.

Methodology

A mix of methods was employed to collect qualitative and quantitative data including Participatory Rural Appraisal (PRA) and structured questionnaire (focused formal survey). Some tools of PRA such as key informant interview, group interview, group discussion and transect walk were adopted as method of qualitative data collection by the multidisciplinary team, which was composed of agricultural experts of the district, Agricultural Economics, Crop Protection, Animal Feeds and Nutrition, Agro-forestry, and Soil and Water Research Divisions of Bako Agricultural Research Center.

Survey procedures

The team made reconnaissance survey and collected secondary data from the then District Agricultural Development Office and Ethiopian Evangelical Church Mekane-Eyesus Western Synods (EECMY-WS) to select the study sites and establish background of the study. Based up on the information generated from reconnaissance survey, the team purposively selected four peasant associations (PAs), namely, K*araro-Guta, Guyo-Tayiba, Riga-Sachi and Buke-Tobara* were included as target areas for the reasons that they were not covered by past surveys, their accessibility and sever termite attack (personal communication with the district agricultural office experts, 2002). The significant effect of termite in affecting the livelihood of farmers residing in the lower and mid altitude zones was considered to decide the major agro ecologies for the present study.

The fundamental research themes considered to address the concerns raised by the survey were:

- the cause and consequences of termite devastation and its implication for crop and livestock production, and natural resource management; and

- What research and development recommendations could be suggested to bring about sustainable solution for the termite problem of the study areas

Based on these research questions, checklists were prepared and used as reminder topics for group discussion and interview. Using the informal survey methods key problem areas (variables) were identified and structured questionnaire was prepared for the focused formal survey. For the informal survey, key informant interview and group discussion participant households were selected purposively. The team formed different groups of farmers taking into account age and gender composition. Out of the total 400 households, sample sizes of 30% were involved as respondents for the focused formal survey.

In order to establish friendly environment between the team and the farmers in the process of data collection, thorough introduction was given by the team about the study plans prior to the start of data collection. This participatory data gathering was commenced by asking the will of farmers to list crop and livestock production constraints and then other natural resources related ones aiming at confirming the farmers about the output of the study. Problem rankings were made by farmers groups on crop, livestock and natural resources. Gender analysis tools, such as activity profile as well as access and control profiles were used by farmer groups (women and men) to summarize data on gender differences.

Data analysis

The data generated using informal survey methods were assessed and presented qualitatively in the text while the qualitative data collected through structured questionnaire were analyzed using SPSS computer software. Descriptive statistics such as percentages and mean as well as independent sample T-test were employed for analysis.

Findings

Description of the study area

Mana-Sibu district is one of the highly termite-infested areas of West Wellega Zone. According to the report from the district Bureau of Agriculture, 85 % of the land under production is highly attacked by termite. Vegetation cover in the district is limited to the bottom valleys where coffee is commonly grown. The major crops are grown around the homestead; because of less termite infestation due to the deliberate drop of dung and house wastes. The lower infestation of termites in the homestead fields was attributable to the diversion of termites to feed on dung rather than crops.

Mana-Sibu district comprises sixty-four peasant associations grouped under eighteen-development. This district has 150,439 populations of which 84.3 % are residing in rural areas and the remaining are of urban dwellers. The men to women ratio are almost one to one with slightly higher number of men in rural and women in its urban counterpart. Out of the total labor force residing in the rural areas, 51% are active and capable of farming signifying high dependency ratio in the district (49 %).

The district is characterised by two major agro-ecologies (midlands and lowlands). Sixty-eight percent of the district lies in the midlands, which ranges between 1500 and 1740 m. The lowlands constitute 32 % and ranges from 500 to 1500 m of elevation. Nitosols are the dominant soil types in the district, which are sandy, and clay in texture. Sandy soils cover 70 % of the area.

Farming systems

Mana-Sibu is characterized by crop-livestock farming systems; though the level of contribution of each enterprise to the economy of small-scale farmers is less understood. The sub-systems of the district were categorized into three based on the importance of the crop to the household economy (Girma et al., 1999), namely coffee-based, maize-based and tef-based farming systems.

In the first farming system, coffee stands number one in sustaining the household. Maize and tef are the economic crops of the area in their respective sub-system. The degree of socioeconomic and physical constraints obviously varies across these farming systems.

Maize, sorghum, coffee, tef, finger millet, haricot bean and noug are important crops grown in the study area. The largest share of cultivated area was occupied by maize (34.84 %) followed by sorghum (24.38%), coffee (12.22%) and tef (8.67%) (Table 1).

Table 1. Major crops characterizing Mana-Sibu Farming System

Crops	Area under crops (ha)	% of cultivated area
Maize	12678.75	34.84
Sorghum	8871.50	24.38
Coffee	4445	12.22
Tef	3156.50	8.67
Finger millet	3045.50	8.37
Noug	2133	5.86
Haricot bean	2057	5.65
Total cultivated area in hectare	36387.25	99.99

Sources: MOA 2002

Small-scale farmers of Mana-Sibu are living in a farming system highly infested with termite. Termite has changed the living behavior of the farm community, soil fertility, pattern and composition of crop and livestock production of the district.

There are a few efforts made by the local non-governmental organization Mendi Environmental Rehabilitation Project to

control this pest. Currently, migration of the people from highly infested area has become a common phenomenon. It was found in this study and others (ICRA, 1998) that termite could cause heavy damage to coffee, field crops, trees and grasses, residential houses.

The pattern of crop production, in the district, is changing from time to time mostly due to high termite attack and lack of effective control. Crop production is affected both directly (damage on the field) and indirectly (through land degradation). As a result, shift in crop enterprises were seen over years. Similar justification holds for Livestock, too. The change in natural resources like grass species, trees and shrubs are also common.

Demographic and socio-cultural situations

The statistical analysis showed that the average sizes of the family were 7.7 in the lowlands and 7.5 in the mid-altitude zones, which is almost size of 8 per household (Table 2). F-test showed non-significant difference in the variance of the family size between the two agro-ecologies. Similarly, equality of the mean of family between lowland and mid-altitude zones were tested using Independent Sample T-test and resulted in non-significant differences. It was also indicated from PRA that the minimum and maximum household size of Mana-Sibu farmers ranged from 2 to 12. This large number of family size goes to the degree of prestige traditionally given to the number of family size. In the rural areas it is also, true that a family having more number of children will not face labor shortage in the peak seasons. On the contrary, there existed disguised unemployment in the area for medium and poor farm households because of the lack of farm resources such as land, oxen, and farm implements. On the other hand, the opportunity cost of withdrawing any number of family labor for other jobs is very minimal suggesting more potential scope to maximize the efficiency of labor in the area.

Table 2. Socioeconomic and demographic characteristics of Mana-Sibu households

Variable	lowland		midland		F-Test	T-Test
	number	mean	number	mean		
Family size (No.)	49	7.7	26	7.5	2.89***	0.21
Farming experience	49	28.5	46	20.78	2.50***	2.61*
Farm size (ha)	49	2.65	38	2.88	1.56	-0.41
▪ Cultivated	49	1.80	47	1.70	1.56	0.25
▪ Coffee land	14	0.44	14	0.88	3.85**	-1.60***
▪ Grazing land	13	0.95	22	0.67	0.13	0.90
▪ Fallow land	17	0.61	23	0.69	1.54	-0.43
▪ Forest land	14	0.64	22	0.53	0.34	0.57

*NB. *, **, *** denote significance at 1%, 5% and 10 %, respectively. Number in table indicates the size of observation included in the analysis.*

Scattered and small landholdings characterize most of the farmers in the area. Small-scale farmers owned an average of 2.65 and 2.88 hectares in the lowland and mid-altitude zones, respectively. None of the variances between the low and mid altitude zones was statistically significant. Significant differences were observed between the two agro-ecologies only for area allocation of coffee plantation. Larger area of land was allocated to coffee in the mid-altitude zone than in the lowlands.

Ownership of other resources of the two zones was presented in Table 3. From this analysis, it was observed that large number of cows and oxen were owned by lowland farmers as compared to their midland counterparts. The ownership pattern and composition were found to be non-significant for other resources showing that homogeneity of the small-scale farmers with respect to resource ownership.

Table 3. Resource ownership patterns

Variable	Lowland		Midland		F-Test	T-Test
	Number	Mean	Number	Mean		
No. of bee hives	18	22.20	21	19.10	0.01	0.66
Number of cows	40	4.70	30	3.10	4.10**	1.97
Number of donkeys	33	1.73	21	2.10	2.40***	-0.60
Number of Goats	6	5.20	7	3.60	1.07	1.72
Number of heifers	39	4.50	27	3.20	1.82	1.53
Number of oxen	37	2.10	30	1.53	3.04***	1.88***
Number of poultry	37	7.03	35	8.10	0.20	-0.61

*NB. *, **, *** denote significance at 1%, 5% and 10 %, respectively. Number in the table indicates the size of observation included in the analysis.*

Access and control of resources

Table 4 presents the gender role in the households of Mana-Sibu district. Like any other regions of the country, the major farm resources include land, labor, live animal, plow, sickle, and hoe. It was observed that there exists variation in the freedom of access and control over these resources between men and women. Traditionally, men have a potent power over the resources of the family. It was arranged socially that sale and purchase of live animals and crop grains of the household are performed by men; while retailing of smaller quantities of grains and low valuing animals are accomplished by women.

Table 4. Gender roles of farm households

Type of resources	Control	Access	Benefits
Farm resources	Men	Men	Both
House utensils	Women	Women	Both
Livestock	Both*	Both	Both
Crops	Both*	Both	Both
Off farm products	Men	Men	Both

**the control over crops and live animals is very limited for women but generally women has no potency to control every resource which was sometimes led to conflict and divorce.*

For women, a thorough discussion with the husband is required to sell poultry. It was recognized during the PRA work that this potency of the men over resources had no harm but has reflected the betterment of the family in the society. Most farmers in the study district believe that the difference in gender role is natural, cultural and ancestral, but it was not created to show the potency of men households over resources. As regards labor for termite control, there has been minimum involvement of women in the household for the termite control activities like mound destroying, unlike their full involvement in the other farm activities that start from land preparation through harvesting to storage.

Household typologies

Identification of target groups for future research and development is very crucial, as the agroecology based technology generation is becoming the top priority in reduction of poverty in the country, in general, and the region, in particular. In this study, wealth-ranking exercises were made by the farmers themselves and facilitated by the multidisciplinary team from Bako Agricultural Research Center. The results were summarized in Table 5. Number of livestock owned, number of coffee farm owned, farm size and type of house built by the farmers were the major criteria used in categorizing the community into relatively rich, medium and poor. The district Agricultural experts also substantiated the finding that about 70% of the farmers are under the poor category.

Table 5. Farmers' perception and indicators of wealth in the district

Rich	Medium	Poor
10% of the total owning 68-99 Cattle	20% of the total owning 16-25 Cattle	70% of total own 2-3 Cattle
owning 10 oxen	owning 3 oxen	owning ≤1 ox
own 2-3 donkey, mule	Owning 1 donkey	no donkey
Owning 1.25 ha of coffee or 3000 coffee plants	Owning 0.75 ha of coffee or 700-800 coffee plants	Owning 0-100 coffee plants
Owning 4 ha of land	Owning 2 ha of land	Owning ≤1 ha of land
Owning house built from corrugated iron sheet	House built from grass thatched roof or corrugated iron sheet	House built from only grass thatched roof
More *bonee* land /valley bottoms/ Construct house in the town	Less *bonee* land -	no *bonee* -

The three groups of farmers had different vision as to how termite attack could be minimized and if possible be controlled in their farming system (Table 6).

Table 6. Farmers' perception towards termite attack by wealth category

Rich	Medium	Poor
• Give high attention to termite control • Locally hire daily labor to destroy termite mound from their farm. • They want and afford to buy chemicals for termite control.	• Give attention to termite control • They are involved in destroying termite mound from farm • They want to buy chemicals in cash or in credit.	• Reluctant to control termite • They do not want to buy chemicals but suggest community or government forces to destroy termite mounds

It was evidenced from a study that resource poor farmers did not want to pay much attention to termite control, as they had nothing outside of their home. Had it not been for lack of most of the physical resources to be damaged, they would have been equally affected by this insect pest. In general, all groups of farmers of Mana-Sibu district though the severity of resources damage for rich and medium groups is painful, have been suffering from termite attack for the last 50-60 years. The intensity of the problem forced some of the farmers to leave their homes and settle in forest areas. This resulted in destruction of forests for farmland and settlements, which in turn, led to many interrelated ecological and social problems.

Termites and farmers' socioeconomic conditions

The socioeconomic conditions of Mana-Sibu farmers were highly correlated with termite attack. Every problem was related to termite directly or indirectly. On the other hand, the weight given to termite problem varied across farmer groups.

It is important to note that farmers of different wealth background face different socioeconomic problems (Table 7). It was reconfirmed that termite attack is the pressing problem for the rich farmers followed by the medium ones. Because of its mild effects on them, poor households did not perceive termite as a problem of production instead lack of land, livestock and cash were considered as bottlenecks for them to get out of poverty.

Termites are causing problems such as land degradation, damage of trees, shrubs, and grasses. This could be interpreted

as shortage of livestock feed, soil infertility, and change of climate due to deforestation. Consequently, live animals lose potential for disease resistance. These problems suggested the immediate intervention to save the people from termite attack.

Table 7. Socioeconomic constraints of small-scale farmers by wealth category in order of importance

Rich	Medium	Poor
• Feed shortage	• Feed shortage	• Food shortage
• Livestock disease	• Livestock disease	• Lack of land
• Termite attack	• Termite attack	• Lack of draft power
• Shortage of labor	• Cash shortage	• Cash shortage
• Management difficulty	• Inadequate food	• Lack of seed

Crop Production

Cereals

Cereal crop fields were found to be more affected by termite as compared to other crops. The major crops cultivated across the four sites include maize, sorghum, tef and finger millet in their order of importance. Noug has been grown only in Buke Tobora and Kararo Guta PAs. Where as Pulses, such as haricot bean, field pea and faba bean, have been grown in small amount around homestead as a garden crop. In the study area, coffee, horticultural crops (sweet potato and yam) and fruits (orange and mango) were cash crops serving as source of income in all peasant associations.

Table 8. Crop cultivars * grown across the PAs

PAs	Maize	Sorghum	F. Millet	Tef	Noug
Buke- Tobora	1. Oromee 2.Improved varieties	1. Dhapo 2. Bobe 3. Mera 4. Anichiro	-	1. Muri 2. Tafi adi 3. Tafi dima	Nugi -guracha
Kararo - Guta	1. Keniya 2. BH-660	1. Misinga dima 2. Misinga adi 3. Bobe	1. Daguja guracha 2. Malwa	1. Muri 2. Tafi Adi 3. Tafi dima	Nugi-guracha
Riga - Sachi	1. Oromee 2. BH- 660 3. Keniya	1. Chabi 2. Dhapo	1. D. dima 2. D. guracha	1. Kontol 2. Muri 3. Dabi	-
Guyo - Tayiba	1. BH-140 2. BH- 660 3. Keniya	1. Mis adi 2. Chabi 3. Bobe	1. D. dima 2. D. guracha		-

*Remarks: * Vernacular names are used in the table*
D- Daguja, PAs- Peasant Associations

Trees

Despite the fact that coffee was one of the most important cash crops of the farmers, its plantation has been restricted to valley bottoms where shade trees were available. The cultivars under production were both the local and improved cultivars. Here local cultivars were severely attacked by coffee berry disease (CBD) and die back at seedling stage. The recently released cultivars were more preferred by farmers because of their tolerance to CBD

compared to the local ones, although farmers pointed out that these cultivars have short life span.

Fruit crops grown in these areas include orange and mango. These crops were serving as cash crop for some of the farmers of the study area. Leaf and fruit spot (*Cercospora leaf spot)* were important diseases of orange in all areas specifically in Riga Sachi. The disease symptoms appear as black pustules on fruit and leaves, and reduce the quality of the fruit. Farmers damp infected fruits before they disseminated the diseases to the healthy ones. The farmers were demanding for resistant cultivars and fungicides to over come the problems. Anthracnose Leaf spot caused by *colletitricium spps* has severely attacked mango fruit and reduced the quality of the fruits.

Roots and tubers

Farmers used to grow root crops around their homestead to generate income and for home consumption. These crops included potato, sweet potato, yam and taro. Because of their tolerance to termite, as farmers said, these root crops are very good sources of food, especially during food shortage months prevailing in the area. The reason for tolerance of these crops would be researchable area to be investigated in the future.

Cropping system

In all sites, mono-cropping system was being practiced around homestead and crop fields. This type of cropping system exhausted the potential of the soil and resulted in soil fertility decline. Nevertheless, in some of the studied areas farmers have practiced intercropping cabbage, haricot beans, potato, pumpkin and gourd with both off-season maize and main season maize and rarely in sorghum field.

Fallowing and crop rotation were also common practices. The period of fallowing extends from 3 to 7 years due to extensive land degradation by interference of both termites and human being. In the crop rotation system maize, tef, sorghum and noug were grown one after the other.

Production constraints

The output of crop production in the study area was declining from time to time due to different factors. The major production constraints across the four-peasant associations include termites which will be discussed separately in the next section, livestock diseases, soil erosion and soil fertility decline, crop diseases, insect pests and weed infestation.

Among insect pest of the area Stock borer, Weevil, Shoot fly, Aphid, African bollworm (ABW) and Cutworm were the major ones. Some times Armyworm was considered the major insect pest despite its sporadic nature. Specially, Stalk borer was reported to be one of the yield reducing factors in all areas, particularly on maize and sorghum. Farmers have been using crop residue and aftermath management practices such as burning or removing crop residues left in the field to combat Stalk borers.

Other crop production constraints to be mentioned for the area were weeds. Some of the weeds flora found in the study areas included *Gizotia scabra*, *Agritem conizoyid,* Cynodon *dactylon*, *Digitaria scatarum, Elucine* i*ndica, Commelina spps, Bidens pilosa and Lollium spps.* Hand weeding was a common used control option for most of the farmers in the area, while some of them have used herbicides such as 2-4D with different rates of their own.

The grains of crop after harvest were stored in a locally made storage structures constructed from mud and sticks, and some times stored in sacks for immediate uses. The major problems in stored grain were the damage caused by weevils, rodents and grain molds.

Livestock Production

Livestock has been a major component of the farming system in the study area. Livestock types found include cattle, sheep, goats, equines and chicken. Farmers used to rear livestock mainly for draft power, milk, meat and transport. They also consider livestock as a source of economic security, cash income, and socio-cultural values.

Even though Livestock production was considered as one of the important components of the farming system, its sustainability is being threatened by a number of problems such as feed shortage and diseases.

Constraints

The major constraints of livestock production in the area are feed shortages, diseases, and in adequate veterinary services.

Feed shortage was the most serious problem of the area. Communal grazing of livestock was practiced in the area. Farmers reported that continuous grazing of the area for more than three to four years results in an increase in the presence of termite and consequently damage on pasture. On overgrazed land in the study area, especially during the dry season, termite removes the remaining dry grasses and grass litter leaving the soil bare and giving the false impression that they are primary cause of denudation, Gauchan *et.al.*1998. The most commonly available animal feeds included natural pasture, such as B*amboo spps, Hypehenia spps, Combretum molle, 'Gambeloo' Cynodium dactilon, Pennisettum shemparii, Clover spps, Vernonia amygdalina, 'Chomo'.* Some forage species were observed to be disappearing from the natural grazing areas due to termite. These included *Bamboo spps, 'Daggala', 'Gambeela', Berchemia discolor and Clover spps.* There were also some species, which have not been there before but now emerging in the area. To mention one, P*ennisettum shemparii (Muri),* which perhaps had negative effect on the teeth of the animals because of its strong and rough nature that can break the teeth of animals when grazed, as commented by farmers.

No termite resistant indigenous forage species was identified during the survey; instead, there were some tolerant species, which might have been due to their fast regenerating ability after termite attack, as farmers reported (see Table 10). On the other hand, very few improved forage crops have reached so far in the hands of farmers, viz., *Sesbania sasban,* Sudan grass and Elephant grass. However, there was no proper production and utilization of improved forage crops due to lack of concern. Crop residue was the most useful source of feed for the animals. Purchase of supplemental feeds (concentrate) was not practiced as such. However, very few farmers were found to feed noug cake for their animals during dry season.

Farmers report indicated that during dry season that runs from January to May animals have been facing such serious feed shortage that requires other copping mechanisms. They used to travel with their cattle to the low land areas of region six and farmers called this movement as transhumance *(daraba).* Unavailability of alternative feed sources coupled with termite foraging of the already available feed sources were responsible for feed shortage during those seasons which, in turn, predisposes the livestock to various diseases.

Table 9. Forage spps identified as susceptible and tolerant to termite

Susceptible	Tolerant
Clover species	*Berchemia discolor*
Elucine jaegeri	*Cynodom dactylon*
*Miigra (Vn)**	*Snowdenia polystachia*
	*Chomo (Vn)**

* *Vn- Vernacular name*

Degradation of Natural Recourses

Soils

Soil degradation along with other factors was also identified as the cause for the decline of agricultural production and productivity of the area. The active part of the topsoil, which is rich in organic matter, was regularly removed by run off water and wind caused partly due to the removal of vegetation cover by termites. Termites also excavate the unfertile sub soil to the surface in the process of mound formation. The removal of organic matter had an adverse effect on crop productivity, because it improves soil physical, chemical and biochemical properties such as exchangers or adsorptive agents function as a buffer system for the pH value and ion concentration, especially in the soil solution (Wodman and de Haan, 1997).

Apart from termite, the main contributing elements to soil degradation of the area were topographic, climatic and socio-economic factors. These included the steepness of the landforms, unwise cultivation practices, overgrazing, extensive agriculture and deforestation. All these factors along with the high rainfall intensity and frequency have aggravated soil degradation. Since soil degradation lead to ecosystem imbalance, there is no question as to why termites became aggressive enemies of human beings. Study conducted in a termite prone areas of Mana-sibu district indicated that the intensity of termite damage on agricultural products was indirectly correlated to the soil fertility status, particularly soil organic matter content (Gauchan *et al.*, 1998), i.e. the higher the organic matter content, the lower would be the termite damage.

To alleviate the problem of soil erosion and thus maintain soil fertility, some physical soil conservation measures were tried in the study area. Terracing, contour farming, wood bund, stone check, and cut-off drain were some of the soil conservation measures introduced by Ministry of Agriculture (MOA) and Mana-Sibu Environmental Rehabilitation Project (MERP). These physical soil conservation practices were not adopted widely because of their

high labour demand. As a result, the farmers have become reluctant to invest their scarce resources because they always strive for the immediate benefits of any technology to solve their pressing problems. In this case, however, the contributions of physical soil conservation practices were not observed within short period. The already degraded land also takes a long period to regenerate, which also discouraged the farmers to adopt the physical soil conservation measures.

Crop rotation and intercropping of maize with some vegetables and pulse crops have been some of the indigenous soil fertility management. The Mana-Sibu Environmental Rehabilitation project has introduced area closure, strip cropping, alley cropping and tree planting, and it can be said as a good start. Crop residue management through burning has also been one of the major traditional fertility management activities though it has contributed to the exposure and continuous washing away of the topsoil. The values of 'vetiver grass' and indigenous grass known as '*chomo*' were well understood by farmers in conserving soil and rehabilitating the degraded land.

Forests

Farmers in the study area said that the area coverage of natural forest in the past was very large. Before 1950s, the area was covered with dense forest. It was from this time onwards up to the late 1970s that the availability of forest in the area started to decline. A dramatic decrease has happened starting from early 1970s to present and now a days few forestlands were seen around valley bottoms and coffee fields. As farmers estimated, nearly 95% of the natural forest was dismantled because of the following major reasons.

Extensive agriculture

The ever increasing human population and its pressure on the use of tree products, and the reduction in the availability of agricultural lands resulted in an over exploitation and loss of the natural forest of the area.

Elder farmers reported that termite has been there for the last five to six decades. Infact, the infestation level was differing from place to place and time to time. The damage level was high in Kararo Guta followed by Riga sechi and Buke Tobera but low in Guyo Tayiba. The presence of termite had not brought any adverse effect on forests in the previous times. But, after interference made by man aimed at expansion of agricultural land with out considering the ecological balance has contributed much to the increase of infestation level and damage of trees in the forests. The damage by termites was not only to trees but also to newly planted seedling of trees. It was also recognized from farmers' interview that there was a wide variation among tree species for tolerance to termite attack (see Table 12). Most of the indigenous tree species were found to be tolerant to termite attack compared to exotic species. For example, *Eucalyptus* tree spps was found the most susceptible of all tree species of the area followed by *Juniperous procera* and *Acacia spps,* especially at their seedling stage. The mechanism of resistance or susceptibility is to be researched again.

In addition, termites being bio-deteriorating agents of wood, the life span of a wooden made houses with out application of chemicals or traditional protection measures was from 2-3 years in Kararo Guta and for the rest study area (Buke Tobera, Riga sechi, Guyo Tayiba) it lasts up to 5-6 years. However, in the presence of traditional protection measures the longevity of houses would be increased 5-6 for Kararo Guta and 10-12 years for the rest of the areas. Farmers have been using traditional wood protection methods like the use of diluted common salt solution applied on the walls of the house, and covering pillar with plastic sheet during house construction.

Table 11. List of termite tolerant tree species identified with farmers

Kararo Guta	Riga sechi	*Guyo Tayiba*	*BukeTobera*
Croton macrostachyus	*Croton macrostachyus*	*Cordia africana*	*Cordia africana*
Faurea rochetiana	*Cordia africana*	*Croton macrostachyus*	*Croton macrostachyus*
Ficus sycomorus	*Ficus vasta*	*Aningeria altissima*	*Prunus africanus*
Ficus vasta	*Cassia alexandrina*	*Combretum molle*	*Faurea rochetiana*
Fagaropsis angolensis	*Ficus sycomorus*	*Faurea rochetiana*	*Ficus sycomorus*
-	-	-	*Syzysium guineense*

Termites

In Ethiopia, about 76 termite species belonging to 25 genera and 4 families have been recorded (Abdurrahman, 1991). The two most economically important species of termites in the country are *Macrotermes subhyalinus* (Rumber), also termed as the Mendi termite common in Mana-sibu area, and Microtermes spp.

The *Macrotermes* colonies form mounds. They cut the stem of cereal crops at underground level causing crop stand losses. While the *Microtermes* live in underground nests, attack the root system, and occasionally penetrate into the stem (Wood *et al.,* 1980). They attack the plant in the later stage of crop development (Abraham *et al.*, 1990).

Previously macroterms (mound forming types) were known to be dominant in the area, but in the present time the subterranean types of microtermes has become dominant in the area most probably due to the change in ecosystem favored them more than the mound building ones.

Termites have caused damage to annual crops, tree species, constructions made of woods such as fences, houses and kraal. Besides, they were the main cause for soil erosion by destroying the natural vegetation cover. In general, they have been the primary cause for interrelated problems that have ultimately resulted in low productivity.

Symptoms and extent of damaged

The symptoms of termite attack were soiling of the damaged plants or material, cutting and wilting of the plant, and termite themselves could be seen on the attacked plants and host materials.

The extent as well as severity of damage on crops' yield due to termite was difficult to estimate and quantify since the yield reducing factors were many and occurring together. The damage and intensity in general have been increasing from time to time

and the frequency of occurrence of the pest was regular, as reported by the farmers.

Control measures

According to elder farmers, the termite mound was observed for the first time at Bafano Koricho (In Mana-sibu District) in 1904. The expansion of the termite problem was enhanced with the expansion of agricultural land, at the expense of natural forests and grasslands. The introduction of agriculture to the marginal lands highly aggravated the soil degradation where termite problem was thus acute. In other words, soil degradation and deforestation have increased desertification and intensity of termite problem in the study area, because of which farmers of the area were being forced to use some management options.

- Cultural
- Botanicals
- Use of tolerant/resistant plant/ species
- Biological
- Chemical

Cultural control

The farmers have been combating against termites with what is accessible at their deposal. These were flooding, smoking, and removal of queens, which had temporary effect. Some farmers have tried to grow crops on termite mound soils, but the crops were stunted, weak stem, and yellowish in colour. This could be related to the nutrient deficiency as well as alteration of physical properties of the termite mound soils. However, some African farmers like Sudanese and others used termite mound soils as fertilizers. Detailed investigation may be required in this line under our condition.

Experiences of these termite control measures showed that none of them was ultimate solutions to the problem. As a result, the farming communities in the study area were highly discouraged in their livelihood. The feeling of the people in the study area was to migrate to the near by regions where they could also face another complex socioeconomic problems.

Botanicals

Some plant parts have bean used as botanical control against termites. For example, the leaf of *Croton macrostachyus* and *Ficus vasta* have bean used for temporary storage of harvested tef to protect against termite attack.

Use of tolerant plants

Many plants have evolved with a natural resistance to termite attack and where possible these should be used in preference to most susceptible plants. Farmers have tried to identify tolerant/susceptible crop cultivars to this particular insect pest. Farmers further explained that crops having succulent and sugary above ground stems are more preferred by termites than with under ground stems. However, this mechanism of tolerance or susceptibility of the crops needs investigation through research. Some of the crop species identified by the farmers are shown in the table below.

Table 10: Crop spps that are susceptible, tolerant and resistant to termite

Susceptible	Tolerance
Maize Tef Hot pepper	Finger millet Root crop (potato, yam, taro, and sweet potato) Niger seed (Noug) Sorghum Coffee

Biological

Biological control is the use of natural enemies to control pest organisms. Natural enemies of pests include predators, parasites and pathogens, many of them highly specific in their action. Termites have a large and wide range of predators, and provide a rich protein source to them. Arthropod predators include scorpions, spiders, solpugids, dragonflies, cockroaches, beetles and some wild animals (Sand W.A. 1976.). During the survey, a wild animal locally named as *Awaldigesa* and ants were identified to be natural predators for termite in the area. However, farmers reported that these predators were being

harmed and reduced in number by the insecticides applied for termite control.

Chemicals

In the past, the Ministry of Agriculture (MOA) in its termite control campaign had used Alderine, Heptachlorine, and DDT for termite control. However, these chemicals were banned worldwide due to their persistence effect in the environment. Recently, the Mana-sibu environmental Rehabilitation Project (MERP) and MOA have been using chemicals such as Pyrenix, Dursban 4 E.C and Diazinon 60% E.C. The survey team was told by MOA that for effective result, these chemicals have to be applied with in two to four weeks interval from the day of damage symptoms is observed.

Research and Development Direction

The study strongly reflected termite as the most serious problem calling for immediate intervention from research, development and policy perspectives. It was becoming the main cause for the pressing problems such as feed shortage for livestock, soil infertility for crop production, residential damage for migration of the household from their home places. The issue of termite in West Wellega zone, in general, and Mana-Sibu district, in particular, may also be considered as policy issue as it strengthens the *vicious circle of poverty* in the area. It is, therefore, imperative to prescribe some major recommendations from research, development and policy perspectives.

Research recommendations

- Screening and promoting crop varieties, trees/shrubs and grass species resistant/tolerant to termite attack based on the identified species through the present or past surveys or introducing from exotic sources.
- Integrated nutrient management through cropping systems, organic fertilizers, improved fallow, and inorganic fertilizers should be intensified.
- Establishing sub-center/ strengthening the existing research center (Bako Research Center) for research in the study area to facilitate termite control studies through research and technical support.
- In the process of developing termite management options in the area, integrated research approach among different disciplines is very essential.

Development recommendations

- Physical and biological soil conservation measures should be further integrated and utilized widely through strong extension service.
- Awareness creation for strengthening agro-forestry practices and application of manure on the farm fields to improve the productivity of the land.
- Area closure of degraded lands could be used to restore the ecology.
- The indigenous and exotic termite management measures could be used as supplementary options when required.
- There needs to be strong extension services and regular training to create awareness for termite management and on the extent of damage that can be caused by the pest in the long run.
- Currently EECMY-WS is running a project '*Mana-Sibu Environmental Rehabilitation Project (MERP)*' by making ditches, terraces, establishment of grass strip, area closure and planting termite resistant trees, shrubs and grasses. Strengthening the termite control strategies started by MERP is sensible to reduce the degree of termite attack and rehabilitate the area itself.
- Land use planning should be developed for the study area to make use of the land according to its capability and replenish the degraded ecosystem.

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