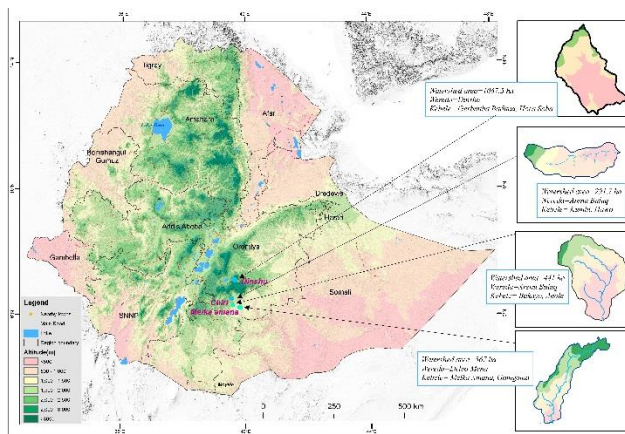


Watershed Development Options in the Bale Eco-Region



SHARE Bale Eco-Region Research Report Series no. 2



ABOUT THE SHARE BALE ECO-REGION PROJECT

Conservation of Biodiversity and Ecosystems Functions and Improved Well-being of Highland and Lowland Communities within the Bale Eco-Region (BER) is one of the European Union (EU) funded projects that stands for Supporting Horn of Africa Resilience (SHARE). In Ethiopia, the project covers 16 districts (Districts) in West Arsi and Bale Zones of Oromia Regional State, around 22,000 km², with a population of about 3.3 million. The project life span is 42 months starting July 2014 and ending in November 2017. Five partners are implementing the project: Farm Africa, SOS Sahel, International Water Management Institute (IWMI), Frankfurt Zoological Society (FZS) and Population Health and Environment (PHE).



Location of the Bale Eco Region (BER) in Ethiopia

Acknowledgements

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Contents

Contents

1	Introduction	6
2	Water and Land Resource Centre’s Role in BER project.....	8
3	Setup of the Observatories	9
4	Land Cover Maps, statistics, and distribution.....	11
4.1	Hora-Soba Land Use and Cover Map and statistics	11
4.2	Hawo Land Use and Cover Map and statistics	14
4.3	Bekaye Land Use and Cover Map and Statistics	16
5	Land use land cover description	18
5.1	Dense Forest	19
5.2	Open Forest.....	20
5.3	Open Woodland.....	21
5.4	Riverine Forest	22
5.5	Shrub land	22
6	Watershed Development Recommendations	23
6.1	Hora Soba Watershed development option	23
6.2	Hawo Watershed development options.....	25
6.3	Bekaye Watershed development option	28
7	Way Forward	31

LIST OF FIGURES

FIGURE 1. LOCATION OF THE STUDY AREA9
FIGURE 1. HORA-SOBA WATERSHED LAND USE/COVER11
FIGURE 2. HORA SOBA LAND COVER DISTRIBUTION13
FIGURE 3. HAWO LAND COVER MAP14
FIGURE 4. HAWO WATERSHED LAND COVER DISTRIBUTION.16
FIGURE 5. BEKAYE WATERSHED LAND COVER MAP16
FIGURE 6. BEKAYE WATERSHED LAND COVER DISTRIBUTION17
FIGURE 7. BEKAYE LAND COVER DISTRIBUTION17
FIGURE 8. DENSE FOREST IN HAWO WATERSHED20
FIGURE 9. OPEN FOREST IN BEKAYE WATERSHED20
FIGURE 10. OPEN FOREST IN HAWO WATERSHED.....21
FIGURE 11. OPEN WOODLAND IN BEKAYE WATERSHED.....21

List of Tables

TABLE 1. 6

Acronyms

BER	Bale Eco-Region
BERSMP	Bale Eco-Region Sustainable Management Programme

Table 1.

Cluster No.	Cluster Name	Altitude range (masl)	Area (ha and % of total)	Woredas in this zone
1	High-altitude	4,377 - 2,300	937,088 (25%)	Adaba, Dodola, Kokosa, Dinsho, Sinana, Goba, Gasera, Goro, Gololcha, Agarfa
2	Mid-altitude	2,300-1,300	1,371,789 (36%)	Nansabo, Harena Buluk, Dallo Mana, Mada Walabu
3	Low-altitude	272 - 1,300	1,494,411 (39%)	Dallo Mana, Mada Walabu, Guradhamole, Barbare

1 Introduction

The Bale Eco-region (BER) (N6° 29', E39° 28' and N7' 10', E39° 57') is known for its national, regional, and global importance in biodiversity and as source of a number ecosystem services. Importantly, over 40 streams and springs originate from the mountains in the BER that drain into five major river systems namely: Wabe-Shebelle, Web, Welmel, Genale, and Dimal, on which an estimated 12 million people in the downstream areas depend for livelihoods. These rivers drain into the Indian Ocean after crossing through the lowlands areas. They are the major sources of water for domestic use, irrigation and hydropower generation. The rivers are also key to link the highland-lowland systems through a flow of ecosystem services and support to biodiversity conservation. The mountains highland part of the eco-region is the water tower for the southern drainage system including the lowlands of Oromia, Ethiopia, Somali, Republic of Somalia and northern Kenya. This indicates that improving the management and restoration of degraded landscapes in the BER through harmonized and inclusive way is key to maintain ecosystem services and improve livelihoods of people living in the lowlands and highlands.

The BER comprises three agro-ecological zones: the highlands (> 2300 m asl); mid-altitude (1500 m – 2300 m asl) and lowland (<1500 m). The livelihoods of the communities in the highland areas are predominantly based on mixed crop-livestock subsistence agricultural system, while the communities living in the mid-altitude and low altitudes are predominantly pastoral and agro-pastoral.

The major challenges in BER include degradation of the natural resource base due to deforestation, expansion of agricultural lands and settlement; agricultural encroachment; overgrazing; forest fire, etc. The forest cover in the BER is declining fast and the eco-system hydrology is negatively affected. Some of the visible impacts include more frequent flash floods downstream, conversion of perennial rivers into ephemeral springs and streams and water shortage for extended period of the year.

Efforts to conserve the Bale Eco-region have been undergoing. Much of the effort has been focusing on protecting the Bale National Park and the forest through Participatory Forest Management (PFM) projects.

The new 'Conservation of biodiversity and ecosystems functions and improved well-being of highland and lowland communities within Bale Eco-region in short known as SHARE – Bale Eco-region project (BER) has been designed with the following objectives:

- (a) Human/Institutional capacity for sustainable NR conservation/protected area management/interdependent livelihoods enhancement in BER;
- (b) Knowledge/ understanding of sustainable eco-regional management practices;
- (c) Improve protected area, watershed and traditional/contemporary natural resource use management systems in the BER, with best practice informing wider land use planning and management;
- (d) Enhance livelihoods of the BER local communities'; and
- (e) Enhance Federal/regional governments' partnership to sustainable BER strengthened.

The project is specifically designed to explore, deepen and disseminate understanding of highland-lowland linkages and integrated ecosystems, land/water and livelihood systems.

To pilot and model an integrated approach to natural resource management in Bale, across the various eco-systems of the Wabi-Shebele and Genale Dawa river watersheds and includes major research and livelihood components. Particularly for the poor people, i.e. small holder farmers, pastoralists and forest communities, it aims to increase the sustainability of the natural resources they rely on and to increase their household incomes. This includes encouraging people to take responsibility for their local environments and to manage and using these and their assets for lasting and better productivity.

2 Water and Land Resource Centre's Role in BER project

IWMI is leading the research component of SHARE BER project. The Water and Land Resource Centre – as member of research consortia established under the BER project by IWMI is responsible in the following undertakings:

1. RESEARCH: Baseline of Natural Resource Base and Ecosystem Services in and around BER

- 1.1 Audit of natural resources, including highland-lowland dependencies, carrying capacity and NR use
- 1.2 Assessment of hotspots of environmental degradation including impacts and drivers of change, resilience of water under different LU scenarios

2. MONITORING: Hydro-meteorological monitoring in three selected Learning Watersheds in BER

- 2.1. Support selection of three appropriate LWs and install monitoring set-ups in the LWs;
- 2.2. Baseline survey (biophysical and socio-economic) of the three LWs;
- 2.3. Develop data collection plan and exit strategy;
- 2.4. Supervision of hydro-meteorological monitoring including data analysis and synthesis, using students from local universities;

3. INTERVENTIONS: Integrated Watershed Management interventions in LWs

- 3.1 Awareness creation and training on participatory watershed development approaches, principles and practical application and on Sustainability Guideline (an inbuilt exit strategy);
- 3.2 Check and support development of community based watershed development plans;
- 3.3 Organize study tours for experts and land users to WLRC LWs;
- 3.4 Conduct Periodic Performance Assessment of the watershed development efforts;

For the purpose of demonstrating the contribution of integrated watershed development and management approach to the promoting sustainable land and water management, IWMI and WLRC along with all the project partners have established three learning hydro-sedimentology observatory cum learning watersheds each representing the three agro-ecologies. The first site is in Hora-Soba Kebele in Dinsho Woreda representing the highland agro-ecology; the second located in Hawo Kebele in Harena Bulluk woreda representing the mid-altitude; and the third is Angetu Kebele again Harena Bulluk Woreda.

WLRC has established climate and hydro-sedimentology observatories in each Kebele and data collection is in progress. This report outlines proposed watershed development options based on the field survey, land use land cover and topography analysis.

3 Setup of the Observatories

The observatory site selection passed through a serious of consultations, and office and field works. The pre-field work was mainly consultation with project partners and identification of candidate sites using Google Earth.

Four field visits were organized until now to select the observatory sites. The first visit was a preliminary sites visit for a reconnaissance survey and to understand the eco-system; secondly, a team composed of IWMI, CDE of university of Bern, WLRC and BER staff was made to validate sites suggested mainly based on GIS and field visit. The third visit was to identify the mid-altitude observatory as it was unsuccessful during the earlier visit. Baseline Survey

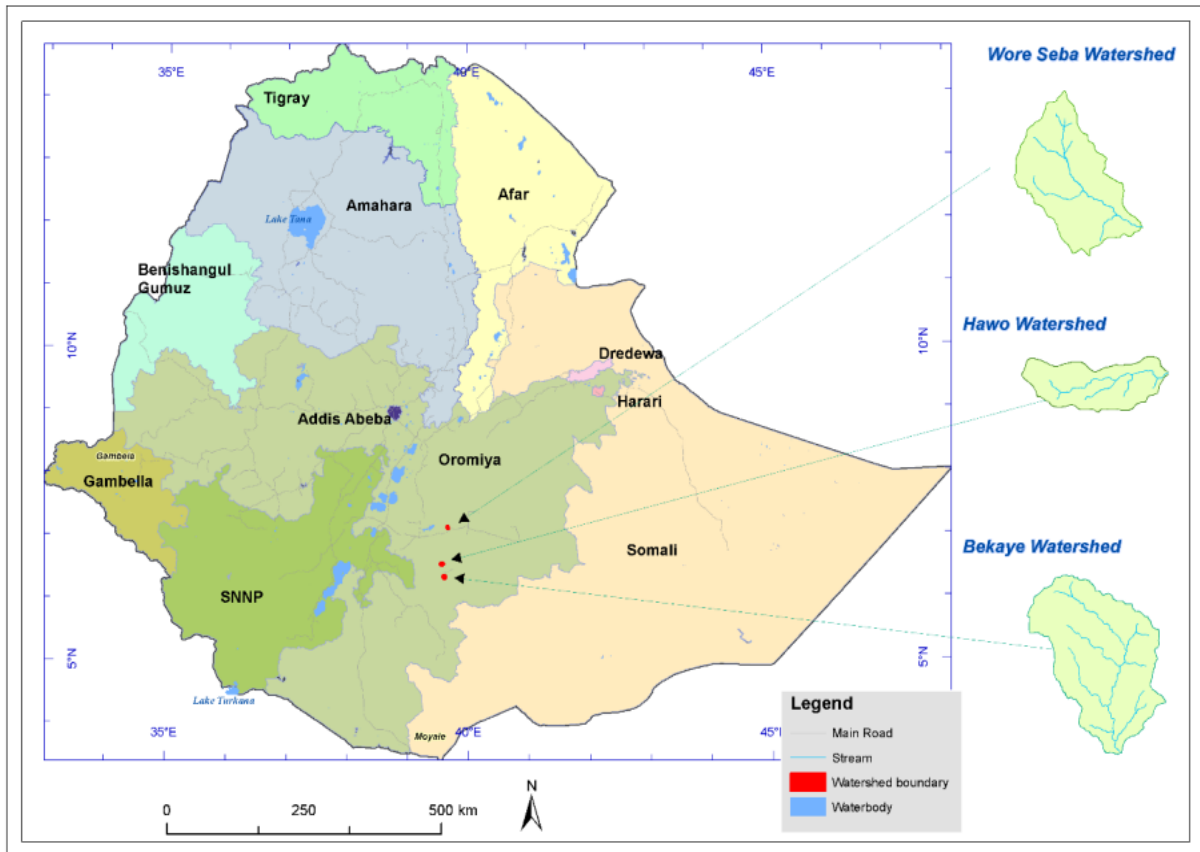


Figure 1. Location of the study area

The fourth visit comprised of GIS, watershed, socio-economics experts. The objective of this visit was to undertake the baseline survey in the four watershed Hora-soba, Bekyaye, Hawo, and Melka Amana. The Melka Amana site is one of the watershed being developed by FARM Africa. However, there will not be

any observatory as it has not been possible to find a river/stream cross section to establish monitoring sites.

The biophysical team made transect walks in the watersheds to understand the land use/cove status, assess the level of degradation, and suggest the watershed development options.

The socio-economic team piloted the survey questionnaire (attached) and shared the same to BER field office for comments. The field survey will be done around end of June 2016.

4 Land Cover Maps, statistics, and distribution

4.1 Hora-Soba Land Use and Cover Map and statistics

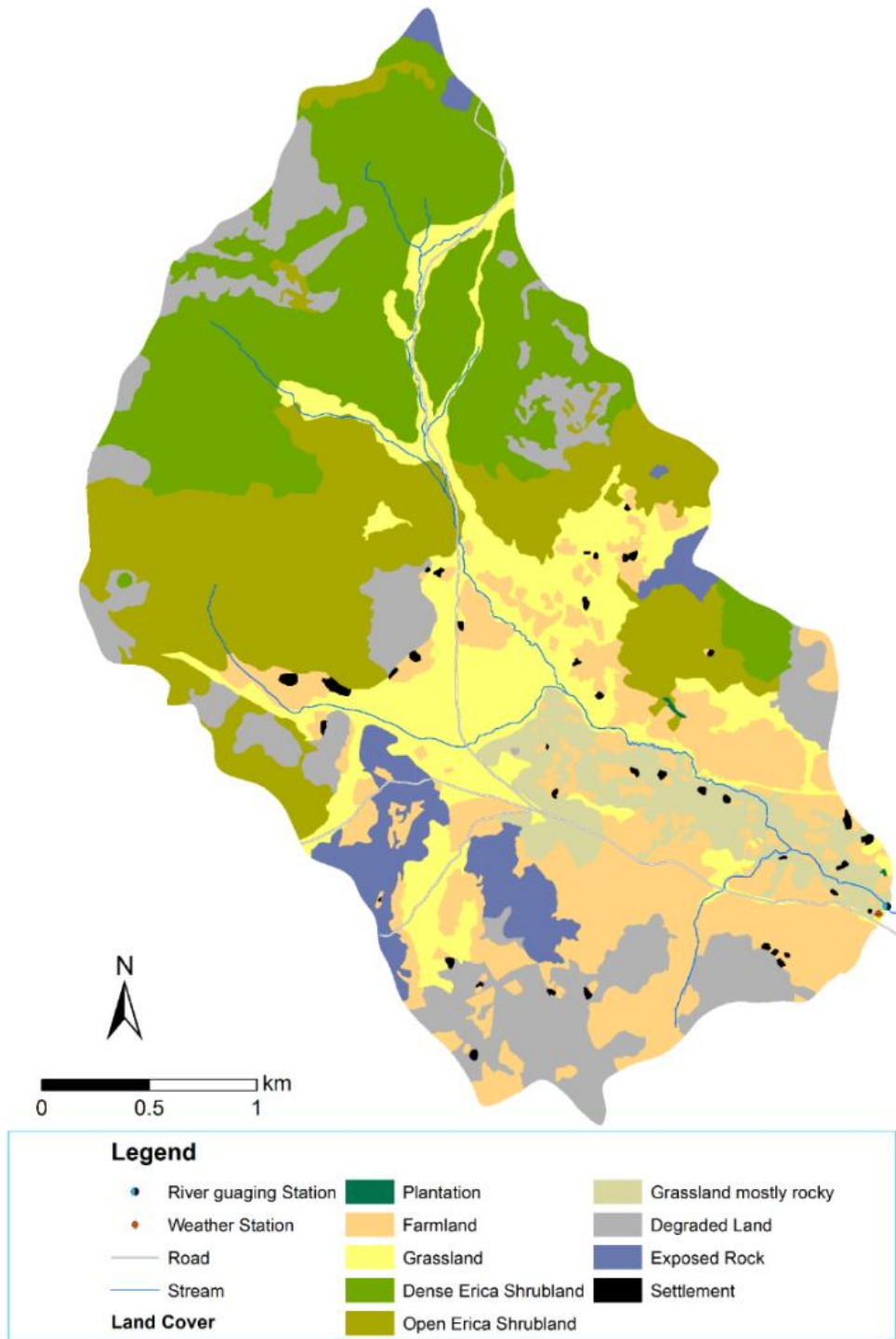


Figure 1. Hora-Soba watershed land use/cover

Table 1. Hora Soba watershed cover statistics

Land Cover	Area (ha)	Percentage (%)
Degraded Land	142.0	13.6
Dense Erica Shrubland	240.6	23.0
Exposed Rock	48.6	4.6
Grassland mostly rocky	57.1	5.5
Open Erica Shrubland	214.6	20.5
Plantation	0.4	0.0
Grassland	159.1	15.2
Farmland	178.3	17.1
Settlement	4.6	0.4
Total(ha)	1045.2 ha	100

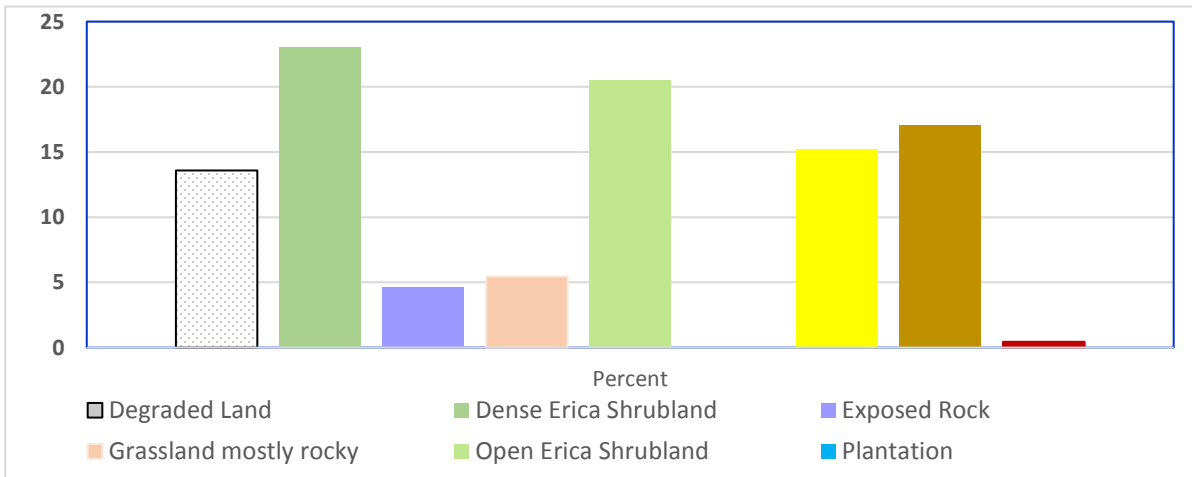


Figure 2. Hora Soba Land Cover distribution

4.2 Hawo Land Use and Cover Map and statistics

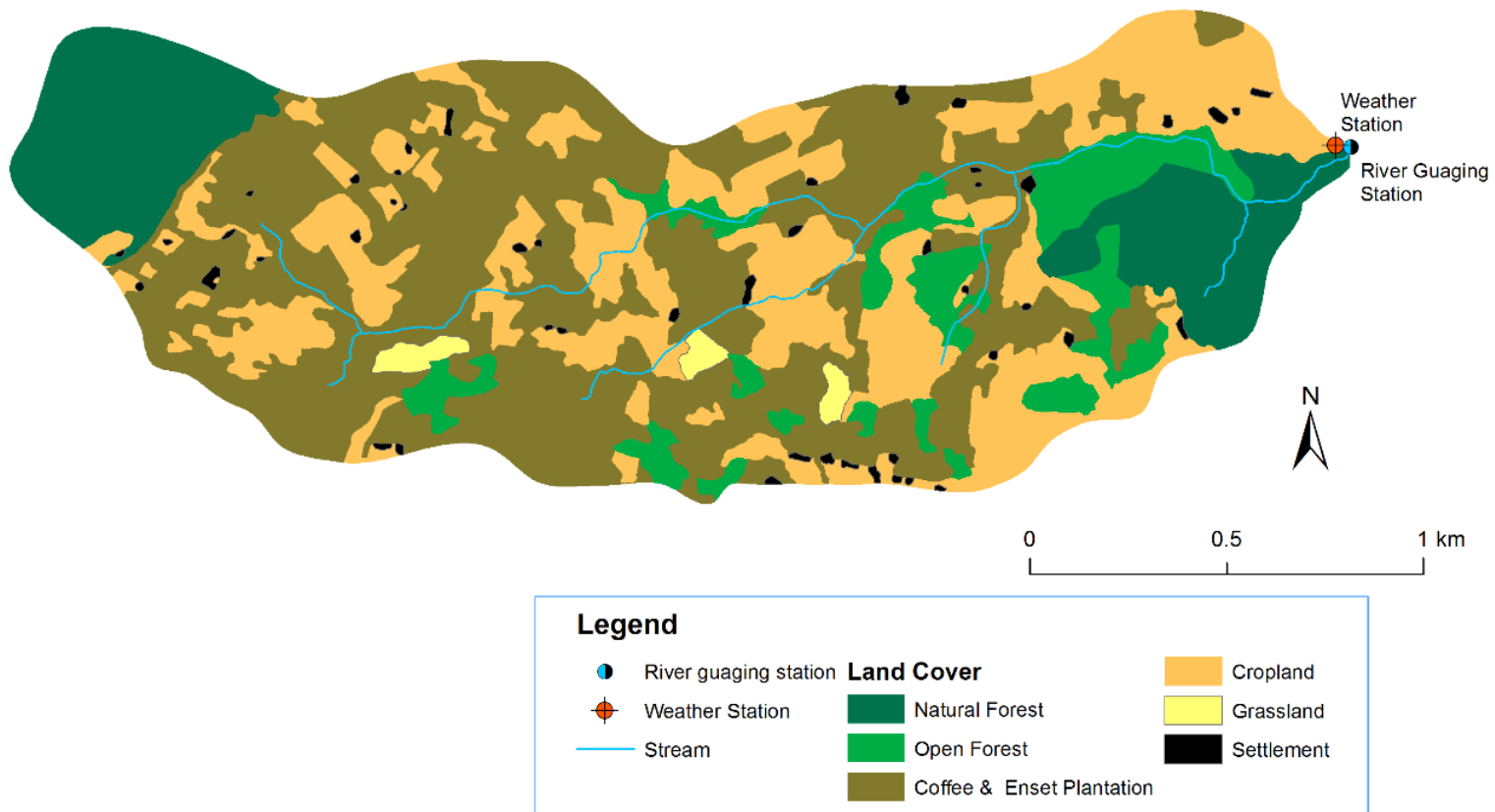


Figure 3. Hawo land cover map

Table 2. Hawo watershed land cover statistics

Land Cover	Area (ha)	Percentage (%)
Coffee & Enset Plantation	133.2	46.1
Cropland	81.7	28.3
Grassland	2.9	1.0
Natural Forest	41.4	14.3
Open Forest	26.9	9.3
Settlement	2.6	0.9
Total	288.7	100

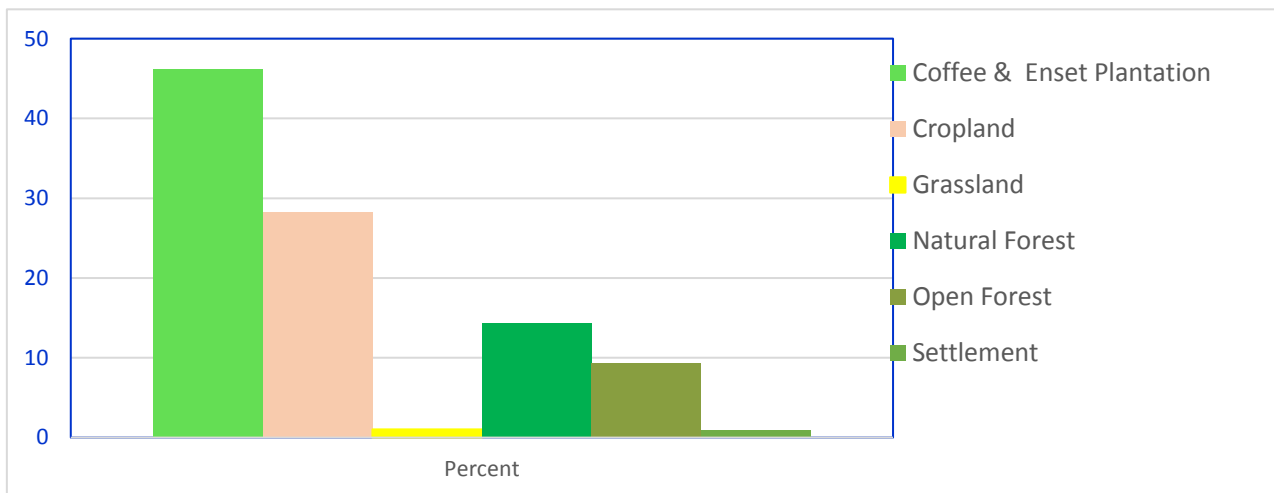


Figure 4. Hawo watershed land cover distribution.

4.3 Bekaye Land Use and Cover Map and Statistics

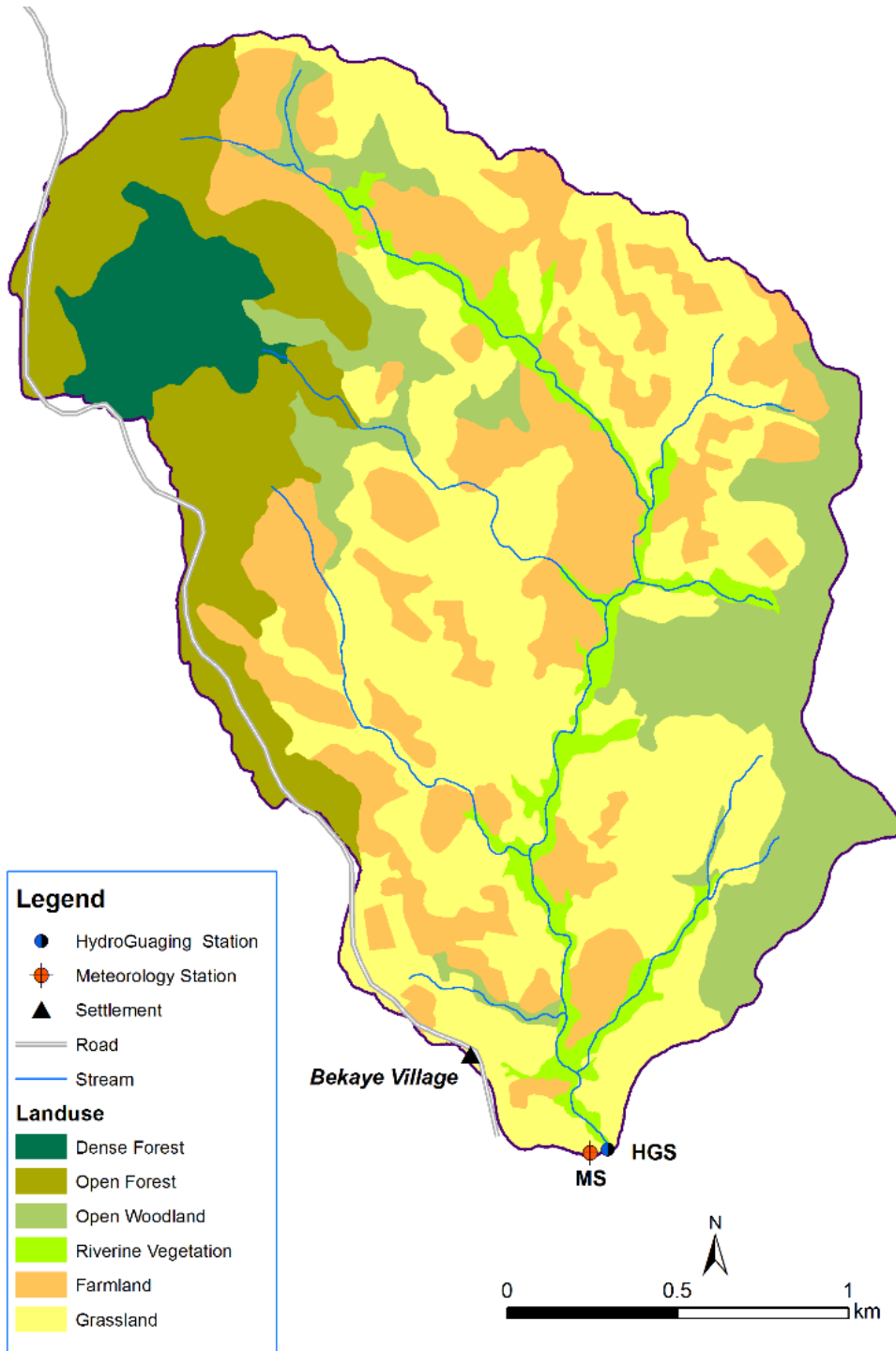


Figure 5. Bekaye Watershed Land cover map

Table 3. Bekaye Land cover statistics

Land Cover	Area (ha)	Percentage (%)
Grassland	184.7	37.1
Farmland	117.1	23.5
Riverine Vegetation	27.6	5.5
Open Woodland	71.9	14.4
Open Forest	71.7	14.4
Dense Forest	25.2	5.1
Total	498.1	100

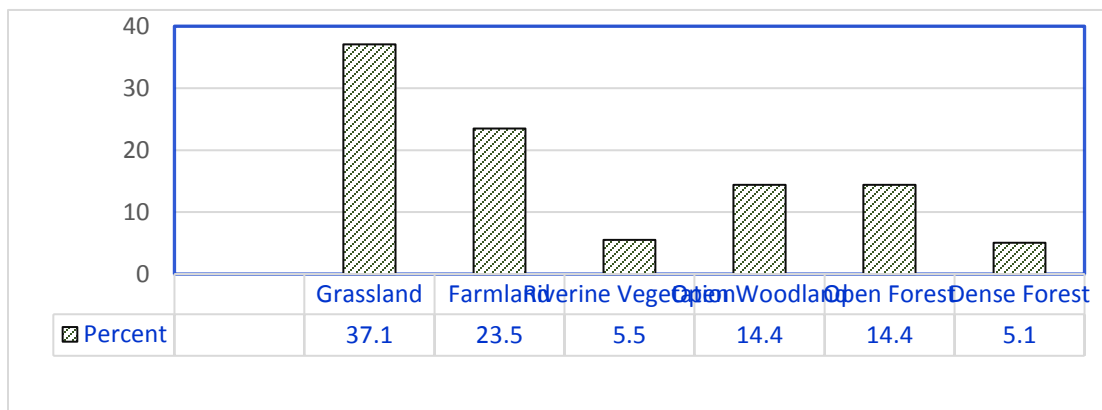


Figure 6. Bekaye watershed land cover distribution

Figure 7. Bekaye Land cover distribution

5 Land use land cover description

The land use land cover deception used in planning the watershed development is outline in the following table.

Table 4. Summary of Land cover descriptions

Land Cover	Abbreviation	Description
Dense Forest	DF	Forest areas covered with trees that have closed canopy cover (> 60% / hectare)
Open Forest	OF	Forest areas covered with trees that have closed canopy cover (< 60% / hectare)
Open woodland	OWL	Land area that is covered with scattered woods (<25 trees/ ha)
Plantation	PF	is a large piece of land covered by artificial trees such as eucalyptus, Enset, Coffee etc.
Riverine vegetation	RV	Trees growing along the margin or bank of rivers and streams
Shrub land	SL	Areas covered with mainly shrubs and other small sized plant species
Grassland	GL	Land dominated by grass rather than shrubs
Cropland	CL	Land used for growing crops
Degraded Land	DL	Land which has no vegetation cover
Exposed Rock	ER	An outcrop or rocky outcrop is a visible exposure of bedrock
Settlement	SA	A piece of land where people live

5.1 Dense Forest

Forest land may have different definition in different ecosystem but in our field study dense forest is defined as forest areas covered with trees that have closed canopy cover >60% of the mapping unit (a land cover unit classified from satellite image as a homogeneous unit). In Bekaye watershed dense forests are dominated by dominant understory shrubs. Because of its lower altitude (1200m-1400m), trees suffer from temperature stress and has fewer tree species than the midland dense forest in Hawo watershed.

Dense Forest in Hawo watershed has dense canopy trees, climbing vines and shrub layers. There are both disturbed and undisturbed forest areas due to agricultural activity in this watershed.

Figure 2. Dense Forest in Bekaye Watershed





Figure 8. Dense Forest in Hawo watershed

5.2 Open Forest

Open Forest is areas covered with trees that have closed canopy cover <60% of the mapping unit. Open Forest in Bekaye watershed has more open space between trees. However, Open Forest in Hawo watershed is different from Bekaye watershed. One of the reason is that the open Forest in Hawo watershed is created by disturbing the Dense forest for agricultural activity. Currently, trees are replaced with coffee trees and enset plantation by local people.



Figure 9. Open Forest in Bekaye Watershed



Figure 10. Open Forest in Hawo watershed

5.3 Open Woodland

Land area that is covered with scattered woods. By definition open woodlands are tree coverage less than 30% and are characterized by widely spaced trees with short trunks and broad crowns. In Bekaye watershed open woodland is located on the lower altitude part of the watershed.



Figure 11. Open woodland in Bekaye watershed

5.4 Riverine Forest

The characteristics of Riverine forests is different from region to region depending on rainfall, altitude and the adjacent vegetation region. The common definition of riverine forest is forests that dominantly located along river margins and river banks.

5.5 Shrub land

Shrubland, scrubland, scrub or brush is a plant community characterized by vegetation dominated by shrubs, often also including grasses, herbs. Among watersheds in different altitude, Hora Soba watershed is located at high altitude ranging from 3200 m to 3700 m.a.s.l. Due to the impacts of high altitude, Erica shrubs are the dominant vegetation cover in this watershed.

6 Watershed Development Recommendations

The development options recommended for each watershed is described from Table 2 to Table 4.

6.1 Hora Soba Watershed development option

The farming system in Hora Soba Barley/livestock mixed farming system. Accordingly the following development options are recommended.

No.	Activities/Intervention	Unit	Amount
Phase I: Initiation Phase			
1	Undertake all preparatory works and start the planning process		
	Employing watershed technician	No.	1
	Baseline data surveying(at the beginning & end)	«	2
	Organizing CWT	«	1
	Familiarization workshop and training for all stakeholders(from Region, Zone, Woreda and Kebele)	«	1
	Undertaking the detail participatory planning process	«	1
Phase II: Rehabilitation Phase			
1	Natural resource rehabilitation		
1.1	On cultivated lands		
	Protecting from free intervention of animals	ha	178.34
	Physical soil and water conservation measures (graded stone faced soil bund supported by biological).	ha	178.34
	Diversion or disposal structures	km	3
	Soil fertility management		
	Compost application	ha	60
	Green manuring	«	15
	Zero or minimum tillage	«	10
	Agro-forestry: Plantation along the terrace appropriate forage varieties	km	142
	Guarding specially agro forestry areas	ha	178.34
	Cut and carry forage tree and grass on terrace	«	178
	Row seeding	«	178
	Artificial fertilizer utilization	Qt	100
1.2	Grassland		
	Protecting from free intervention of animals/use control grazing	ha	216.13
	Physical soil and water conservation measures	«	216.13
	Applying improving strategies		
	Sowing and planting favorable grass and legume spp.	ha	54
	Weeding	«	216.13
	Manuring	«	27

No.	Activities/Intervention	Unit	Amount
	User group organization	No.	3
1.3	Open and Dense Erica Shrubland		
	Protecting from any free intervention of humans and Animals	ha	455.2
	Applying for appropriate uses	ha	455.2
	User group organization	No.	5
1.4	Degraded Land and Exposed Rock		
	Protecting from any free intervention of humans and Animals	ha	190.43
	Physical soil and water conservation measures	«	95
	Applying improving strategies	«	190.43
	Organizing user groups	No.	3
3	Access to water (for drinking and irrigation)	No.	3
3.1	Schemes to be constructed		
	Hand dug well	No.	30
	Pond construction	«	10
4	Working Tools for SWC structure and others construction	«	40
5	Socio-economic services		
5.1	Flour mill installation	No.	1
5.2	Feeder road construction	km	2
5.3	Community Based Animal Health		
	Working farmers training	No.	2
	Materials and medicines	birr	100,000
Phase III: Economic Development Phase			
1	Homestead Development - Activities that should be integrated		
	Participants HH	No.	40
	Total area covered by settlement and plantation	ha	5.01
	Activities that should be integrated		
	Horticulture (Vegetable, spices & fruits)	No.	1200
	Compost	m ³	800
	Backyard forage development	ha	1
	Small scale animal fattening	No.	30
	Small scale dairy	«	13
	Energy saving stove	«	40
	Honey production	«	13
	Poultry production	«	40
	Water development (shallow wells, ponds or roof water harvesting)	«	40
	Live fencing	«	40
	· Revolving fund	birr	100,000

6.2 Hawo Watershed development options

The farming system for communities in Hawo area tends to be agro-forestry system where coffee and enset are the dominant crops cultivated in the watershed. Accordingly the development options recommended are outlined as below.

No.	Activities/Intervention	Unit	Amount
Phase I: Initiation Phase			
1	Undertake all preparatory works and start the planning process		
	Employing watershed technician	No.	1
	Baseline data surveying(at the beginning & end)	«	2
	Organizing CWT	«	1
	Familiarization workshop and training for all stakeholders(from Region, Zone, Woreda and Kebele)	«	1
	Undertaking the detail participatory planning process	«	1
Phase II: Rehabilitation Phase			
1	Natural resource rehabilitation		
1.1	On cultivated lands		
	Protecting from free intervention of Animals	ha	82
	Physical soil and water conservation measures (graded soil bund and graded Fanya Juu supported by biological).	ha	82
	Diversion or disposal structures	km	1.5
	Irrigation	ha	20
	Soil fertility management		
	Compost application	ha	20
	Green manuring	«	10
	Zero or minimum tillage	«	5
	Agro-forestry		
	Plantation along the terrace	km	65
	Improved seeds and/or improved planting materials	Qt	123
	Guarding specially agro forestry areas	ha	82
	Cut and carry forage tree and grass on terrace	«	82
	Row seeding	«	82
	Artificial fertilizer utilization	Qt	20
1.2	Grassland		
	Protecting from free intervention of Animals/use control grazing	ha	2.93
	Physical soil and water conservation measures	«	2.93
	Applying improving strategies		
	Sowing and planting favorable grass and legume spp.	ha	2
	Weeding	«	2.93
	Manuring	«	1

No.	Activities/Intervention	Unit	Amount
	User group organization	No.	2
1.3	Natural Forest		
	Protecting from any free intervention of humans and Animals	ha	41.35
	Applying participatory forest management		
	Setting up Forest Management Institutions	No.	41.35
	Preparing forest management planning	«	41.35
1.4	Open Forest		
	Protecting from any free intervention of humans and Animals	ha	26.87
	Applying improving strategies		
	Sowing and planting favorable grass and legume spp.	ha	13
	Planting multipurpose trees	«	13
	Constructing fire break	km	0.5
	Organizing user groups	No.	
2	Nursery development		
2.1	Seedlings preparation in the project nursery	No.	500,000
2.2	Storage and fencing	«	1
2.3	Seeds and other planting materials	Qt	0.5
2.4	Polyethylene tube	«	8
2.5	Employing nursery laborers	No.	10
2.6	Working Tools		20
3	Access to water(for drinking and irrigation)		3
3.1	Schemes to be constructed		
	Hand dug well	No.	140
	Pond construction	«	30
	Small scale river diversion weir	«	2
6	Working Tools for SWC structure and others construction	No.	90
7	Socio-economic services		
7.1	Flour mill installation	No.	1
7.2	Feeder road construction	km	2
7.3	Community Based Animal Health		
	Working farmers training	No.	2
	Materials and medicines	birr	100,000
Phase III: Economic Development Phase			
1	Homestead Development - Activities that should be integrated		
	Participants HH	No.	170
	Total area covered by settlement and plantation	ha	135.89
	Activities that should be integrated		
	Horticulture (Vegetable, spices & fruits)	No.	5100
	Compost	m ³	3,400

No.	Activities/Intervention	Unit	Amount
	Backyard forage development	ha	25
	Small scale animal fattening	No.	140
	Small scale dairy	«	50
	Energy saving stove	«	170
	Honey production	«	50
	Poultry production	«	100
	Water development (shallow wells, ponds or roof water harvesting)	«	170
	Live fencing	«	170
	Revolving fund	birr	200,000

6.3 Bekaye Watershed development option

The farming system of Bekaye is agro-pastoral. Hence the following development options are recommended.

No.	Activities/Intervention	Unit	Amount
Phase I: Initiation Phase			
1	Undertake all preparatory works and start the planning process		
	Employing watershed technician	No.	1
	Baseline data surveying(at the beginning & end)	«	2
	Organizing CWT		1
	Familiarization workshop and training for all stakeholders(from Region, Zone,Woreda and Kebele)	«	1
	Undertaking the detail participatory planning process	«	1
Phase II: Rehabilitation Phase			
1	Natural resource rehabilitation		
CL	Cultivated lands		
	Protecting from free intervention of Animals	ha	117.07
	Physical soil and water conservation measures/graded soil bund if need be graded Fanya Juu supported by biological.	ha	117.07
	Diversion or disposal structures(waterway and cut off drain)	km	2
	Irrigation	ha	
	Soil fertility management		
	Compost application	ha	25
	Green manuring	«	10
	Zero or minimum tillage	«	10
	Agro-forestry		
	Plantation along the terrace	km	94
	Improved seeds and/or improved planting materials	Qt	175
	Guarding specially agro forestry areas	ha	117
	Cut and carry forage tree and grass on terrace	«	117
	Row seeding	«	117
	Artificial fertilizer utilization	Qt	72
1.2	Grassland		
	Protecting from free intervention of Animals/use control grazing	ha	185
	Physical soil and water conservation measures	«	185
	Applying improving strategies		
	Sowing and planting favorable grass and legume spp.	ha	45
	Weeding	«	184
	Manuring	«	23
	User group organization	No.	5
OWL	Open woodland		

No.	Activities/Intervention	Unit	Amount
	Protecting from any free intervention of humans and Animals	ha	143.55
	Physical soil and water conservation measures(plantation structures)	«	72
	Applying improving strategies		
	Sowing and planting favorable grass and legume spp.	ha	72
	Planting multipurpose trees	«	500,000
	Constructing fire break	km	1.5
	Organizing user groups	No.	
	Forest land		
	Protecting from any free intervention of humans and Animals	ha	143.55
	Physical soil and water conservation measures(plantation structures)	«	72
	Applying improving strategies		
	Sowing and planting favorable grass and legume spp.	ha	72
	Planting multipurpose trees	«	500,000
	Constructing fire break	km	1.5
	Organizing user groups	No.	
1.4	Dense Forest		
	Protecting from any free intervention of humans and Animals	ha	25.15
	Applying forest management techniques	«	25.15
	Organizing user groups	No.	3
	Establishing honey producing associations		1
1.5	Riverine Vegetation		
	Protecting from any free intervention of humans and Animals	ha	27.61
	Organizing user groups	No.	3
2	Nursery development		
2.1	Seedlings preparation in the project nursery	No.	1,000,000
2.2	Storage and fencing	«	1
2.3	Seeds and other planting materials	Qt	1
2.4	Polyethylene tube	«	14
2.5	Employing nursery laborers	No.	20
2.6	Working Tools		40
3	Access to water(for drinking and irrigation)		3
3.1	Schemes to be constructed		
	Hand dug well	No.	150
	Pond construction	«	30
4	Working Tools for SWC structure and others construction		100
5	Socio-economic services		
5.1	Flour mill installation	No.	1
5.2	Feeder road construction	km	3

No.	Activities/Intervention	Unit	Amount
5.3	Community Based Animal Health		
	Working farmers training	No.	2
	Materials and medicines	birr	100,000
Phase III: Economic Development Phase			
1	Homestead Development -		
	Participants	No.	180
	Total area covered by settlement	ha	
	Activities that should be integrated		
	Horticulture (Vegetable, spices & fruits)	No.	5400
	Compost	m ³	3600
	Backyard forage development	ha	10
	Small scale animal fattening	No.	150
	Small scale dairy	«	50
	Energy saving stove	«	180
	Honey production	«	50
	Poultry production	«	100
	Water development (shallow wells, ponds or roof water harvesting)	«	180
	Live fencing	«	180
	Revolving fund	birr	200,000

7 Way Forward

The watershed development recommendations are suggestions for discussion with and final adoption by the watershed community. Hence watershed community members need to sit together and do the following:

1. Follow the integrated watershed planning processes and ensure that the watershed development is participatory;
2. Establishing watershed team at Woreda, Kebele and Watershed level;
3. Prepare participatory plan together with community watershed team;
4. Endorse the watershed development options with the community the community assembly;
5. Based on the time schedule prepared in the plan starting the watershed development plan;
6. To implement based on the above development option match and follow these options with land cover map;
7. Based on the monitoring and evaluation program prepared in the project proposal start follow up.

Literature

- Abate, T., Ebro, a., & Nigatu, L. (2010). Traditional rangeland resource utilisation practices and pastoralists' perceptions on land degradation in south-east Ethiopia. *Tropical Grasslands*, 44, 202–212.
- Abebe Y. & K. Geheb. (2003). Wetlands of Ethiopia. Proceedings of a seminar on the resources and status of Ethiopia's wetlands. p. 123. Nairobi: International Union for Conservation of Nature