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Biodiversity conservation using the indigenous knowledge system: The priority agenda in the case of Zeyse, Zergula and Ganta communities in Gamo Gofa Zone (Southern Ethiopia).

Abayneh Unasho Gandile*, Solomon Mengistu Tessema and Fisha Mesfine Nake

College of Natural and computational Sciences, Department of Biology, Dilla University, Ethiopia.

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Biodiversity has fundamental values to humans, because we are dependent on it for our nutritional, cultural, economic, and environmental/ecological well-being and the mismanagement of biodiversity leads to resource decline and biodiversity crisis. Moreover, Indigenous Knowledge develops in local contexts to solve local problems, and it is just another form of knowledge which does not set itself in opposition to sciences. However, values of biodiversity and manifold roles of indigenous knowledge including biodiversity conservations are overlooked and are at a risk of getting extinct in general and in Ethiopia in particular. The objective of this study was to collect information on the values of biodiversity, its current status and conservation of biodiversity using indigenous knowledge of the Zeyse, Zergula and Ganta communities in Southern Ethiopia. Data were collected from six focus group discussions (Native Individuals with age range: 30 to120) to achieve the goals of the research and all of the discussants were indigenous members of each community. A qualitative research design was used and the data were organized and analyzed around the key themes of the research.The result showed value of the biodiversity including specific values of plant biodiversity- *Arundinaria alpinak* and *Moringa stenopetala* as human assets for the livelihood of the community. Moreover, the result indicated strong traditional beliefs, laws and customs and affections towards nature to conserve biodiversity including sacred trees and animals (totems). However, the results also indicated, currently, these cultural values of the communities to conserve biodiversity using indigenous knowledge were at a risk of getting extinct/endangered, which resulted in the loss of biodiversity in the study areas. The study result indicated specific values of biodiversity for the livelihood of the communities and strong ties between indigenous knowledge and biodiversity conservation. Therefore, we need to empower indigenous people to protect their culture embodying indigenous knowledge, belief systems of protecting nature, and cultural practices that promote sustainable biodiversity conservation.

Key words: Biodiversity, Indigenous knowledge, wildlife, Nature, Conservation, totem

INTRODUCTION

Background and justification of the study

According to Wilfred et al. (2007), biodiversity refers to a variety of life forms (genes, species, animals, plants and

micro-organisms), ecosystems and the ecological process/ecological complexes in which these components are interacting. Biodiversity also refers to a reciprocal relationship between humans and non- human entities that include plants, animals, minerals; and the spiritual consciousness of the people concerning such relationship (Kimmerer, 2002).This implies that, for indigenous people, biodiversity is much broader than the scientific view of ecosystem as it includes spiritual values of nature through creation.

Biodiversity is directly responsible for 40% of the world's economy, 70% of the world's poor live in rural areas depend directly on biodiversity for their livelihood, and 80% of Africans depend on forest resources for food, shelter, medicine, rural architecture and engineering for their survival (World Bank, 2004; Anthwal et al., 2006; WHO, 2010). Moreover, another study also reflected, the value of biodiversity as indigenous cultures, and recognize biodiversity's value in religious traditions based on honouring the Earth. Proximity to nature has also been shown to enhance emotional and spiritual well-being (Atkinson et al., 2012). Atkinson et al. (2012), also explains, cultural ecosystem services include use-related values such as leisure and recreation, aesthetic and inspirational benefits, spiritual and religious benefits, community benefits, education and ecological knowledge, and physical and mental health.

Furthermore, biodiversity including Ecosystems also provide many services that sustain human health such as nutrition, regulation of vector-borne disease, or water purification and natural settings which could act as a catalyst for healthy behaviour leading for example to increase physical exercise, which affect both physical and mental health (Pretty et al., 2005; Barton and Pretty, 2010). Besides, simple exposure to the natural environment, such as having a view of a tree or grass from a window, can be beneficial, improving mental health status (Pretty et al., 2005). These values indicate a wide scope of biodiversity values for the livelihood of the community.

However, biodiversity loss has been a major concern to mankind, especially during the last quarter of the previous century. This concern culminated in the "Biodiversity Convention" that was opened for signature at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil, June 1992. Since then different international fora, including e.g. the Beijing Conference for Women in 1995 echoed the problems of continuing environmental degradation. In spite of this, ten years after Rio, the World Summit on Sustainable Development (WSSD) was held in Johannesburg, South Africa, from August-September 2002, could only state that in spite of significant efforts, the loss of biodiversity worldwide was continuing at an unperceived speed and a reverse in this ongoing decline should urgently be realized (Hens and Nath, 2003).

What are the causes of continuing loss of biodiversity? The cause of biodiversity loss are multiple and complex. However, studies have shown that, one of the traditionally important causes were the unique focus on the biological factors for the biodiversity loss. During the recent times, extinction rates are ten to hundred times higher than during pre-human times (Sinclair, 2000a). Studies also indicate the main biological causes for this loss of biodiversity include: the loss of habitats, the introduction of exotic species, over-harvesting, illegal hunting, illegal settlements, climate change/ global environmental change, "knock-on" effects and pollution (Sinclair, 2000b; Nasi et al., 2008; SCBD, 2008; Peter, 2008). All these causes have one element in common: they are induced by human activities which threaten the world's biodiversity.

Moreover, a study carried in Ethiopia on Earth Trends: Forests, Grasslands, and Dry lands, states the loss of biodiversity indicating 4% forest cover and an estimated deforestation rate of 8% per year as of 2000 (World Resources Institute on Earth Trends: Forests, Grasslands, and Drylands, 2003 cited in USAID, 2008).The reasons for this deforestation are both direct such as the production of charcoal and timber and indirect such as lack of management capacity and population pressures (USAID, 2008). This makes the overall human activity, the most important cause of the current decline in biodiversity which needs immediate and integrated solution.

Therefore, understanding the many aspects of human influences on biodiversity, and their underlying driving forces, is of crucial importance for setting priorities and counteracting the current negative trends and all of these negative trends can be curved by integrated biodiversity conservation approach including the application of indigenous knowledge system.

Indigenous knowledge (IK) can be defined as a body of knowledge built up by a group of people through generations, of living in close contact with nature, specific to communities and local environments (Johnson, 1992). A broader definition holds that indigenous knowledge is the knowledge used by local people to make a living (livelihood) in a particular local environment (Warren, 1991).

Moreover, indigenous knowledge is much more complex and in fact, a variety of terms have been used to describe this form of unique knowledge. These include terms such as local knowledge, traditional knowledge, indigenous traditional knowledge, indigenous technical knowledge traditional environmental knowledge, rural

*Corresponding author. E-mail: aabbay_u@yahoo.com. Tel: +251911895949.

knowledge, traditional ecological knowledge, and so forth. In this study, the term “indigenous knowledge (IK) ‘’ was used to cover all those concepts of knowledge systems. IK develops in local contexts to solve local problems including conflict resolution, whether fore-casting, biodiversity conservation, solving local health problem in particular and maintaining human livelihood in general. It does not set itself in opposition to science and is just another form of knowledge (Peter, 2008).

Moreover, another study shows, the most notable biodiversity conservation practice were the protection of forests using IK. Wildlife takes refuge in these forests to escape from enemies including forest fires and hunters. The protected forests therefore play an important role as habitats for a high diversity of flora and fauna. Studies also show, plant species vary greatly in these forests, showing that each traditionally protected forest is invaluable as a conservation haven. Some forests were also protected by IK beliefs such as taboos that forbade people to enter them and some trees were declared as sacred and felling them constituted a breach of taboo. The effectiveness of the traditional sanctions is shown by the fact that the forest reserves have been virtually untouched for generations’ and they stand out as ecological museums of local vegetation (Laurel and Nyberg, 2000).

However, IK systems in Africa including Ethiopia have not been systematically recorded and are therefore not readily accessible to policy makers, researchers and development agents although several writers have provided detailed overviews of IK systems in agricultural development, pastoral management, and agro-forestry (Rajasekar and Warren, 1991; Babu, 1991). Morover, IK system is a crucial aspect of sustainable biodiversity conservation including land management (shifting cultivation, mixed cropping, intercropping), and development. These have been proven to be superior in many cases than alien technologies. Indigenous knowledge technologies and know-how rely on locally available skills and materials and are thus often more cost-effective than exotic technologies introduced from the outside (Peter, 2008).

There is historical and contemporary evidence that indicates indigenous peoples have also committed environmental wrongs through over-grazing, illegal settlement, over-hunting, or over cultivation of the land and it is misleading to think of indigenous knowledge as always being “good”, “right” or “sustainable”. Therefore, critically re-examining those beliefs is always useful to consider their purpose rather than their grounding (Peter, 2008).

Moreover, it has been widely argued that documentation of the indigenous knowledge system will motivate wide use, application and easy integration of such knowledge system into other forms of knowledge systems (Msuya, 2007; Shrestha et al., 2008), whereas, lack of documen-tation has been contributing to its decline and its role in biodiversity conservation. Furthermore, elders have been dying without passing on their knowledge system to their grandchildren (Kalanda-Sabola et al., 2007), which threatens its wide use, application and its integration with other forms of knowledge systems (Msuya, 2007).

In Ethiopia**,** with an estimated 85% of the population is dependent directly on the land for their livelihoods, but degradation of the land and biological system is critical that conservation becomes the top commitment of the government to reverse the danger encountered (USAID, 2008) and this needs a holistic approach including IK system to conserve biodiversity.

Rationale of the study

Biodiversity loss has been a major concern to mankind, especially during the last quarter of the previous century which needs an integrated approach including IK to curb this human and wildlife threats. IK can be summed up as the wisdom of a people for survival in their own local environment and it is necessary to integrate indigenous knowledge systems with scientific knowledge to enhance biodiversity conservation and bring about sustainable development.

IK plays an important role in biodiversity conservation and social and economic development of local communities. Sustainable development and biodiversity conservation are intricately linked, because biological resources are fundamentals to development. Conservation permits the continuing use of resources in ways that are non-destructive.

The sustainable use of natural resources by local populations must be based on an understanding of the relationships between human’s IK and their environment. Therefore, conservation of biodiversity using IK at worldwide in general and in Ethiopia in a particular will be the demand of the day.

Therefore, this research was targeted to answer the following questions:

1. What were the specific values of biodiversity for the livelihood of the communities?
2. What was the current status of biodiversity in the study areas?
3. What was the role of IK to conserve biodiversity conservation?
4. How did you compare biodiversity conservation of the past vis-à-vis with the present?

In line with the objectives of the‘’ Millennium Development Goals (MDGs), particularly global poverty reduction by the year 2015’’ the role of IK is paramount, and this research was aimed at to assess and document the values of biodiversity, its current status, and biodiversity conservation using IK, taking specific communities including Zeyse, Zergula and Ganta into account.

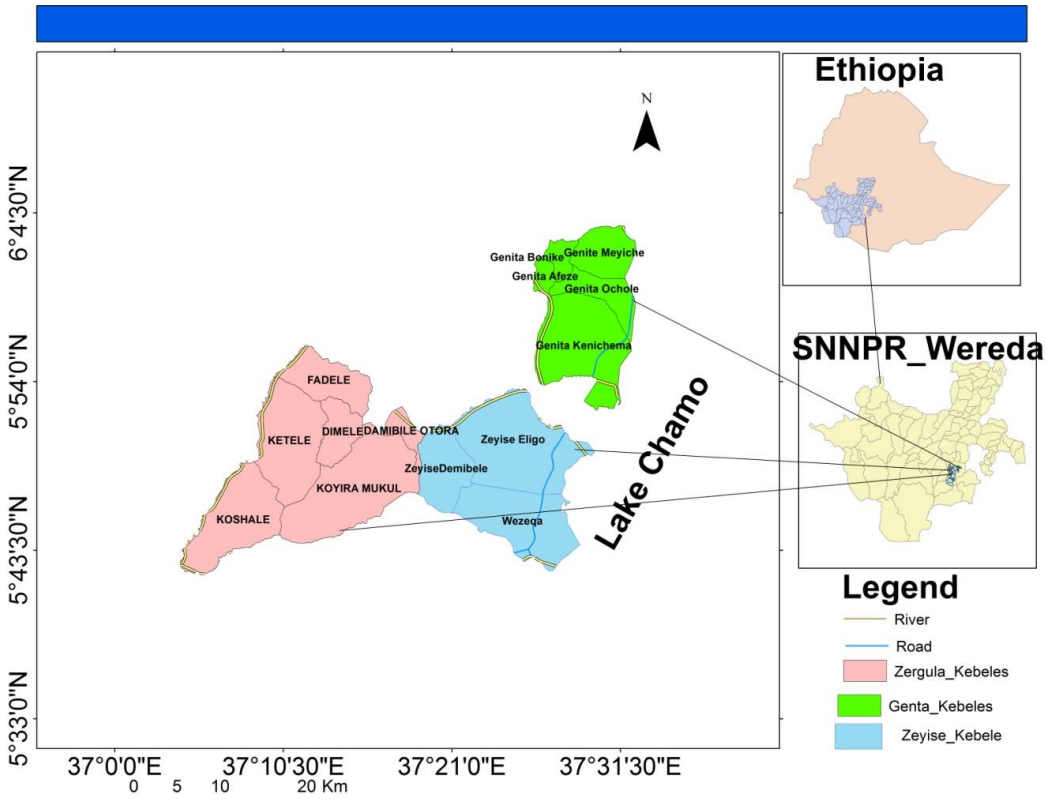

Figure 1. Study Sites (Source: Ethiopia GIS, 2007).

MATERIALS AND METHODS

Description of the study area

Ethiopia is a sub- Saharan African country located in the horn of Arica. It is extremely ethnically diverse country inhabited by more than 80 ethnic groups of which over 56% ethnic groups are indigenous to the Southern Nations, Nationalities and Peoples, Region (SNNPR). These ethnic groups are distinguished by their different languages, culture and socioeconomic organizations.

Among these indigenous Southern communities, Zeyse, Zergula and Ganta communities (Figure 1) are the targets of this study. They inhabit in GamoGofa Zonal region, in both low and high land areas. Lowland regions of Zeyse and Ganta communities are located around Lake Chamo, south of the capital (Arba Minch), but that of the Zergula is located at the western part of Zeyse area.

Like all other indigenous communities, these communities have indigenous knowledge which is important for their survival (livelihood), including biodiversity conservation and development. However, biodiversity conservation using IK of these communities was not studied well and documented. Therefore, assessing the application of IK on biodiversity conservation of these communities was the main concern of this study.

Study design

This study was conducted at Southern Ethiopia, involving assessment and documentation of values of biodiversity, its current status and conservation using the IK of "Zeyse, Zergula and Ganta'' communities. We targeted to these indigenous ethnic groups (= communities), because of their proximate geographical locations and the role of their IK on biodiversity conservation was not previously studied and documented well.

After conduction of pilot study on one of the communities selected, data collection were done using qualitative data collection method that included focus group discussion (FGD) with community adults and elders (Age range = 30-120), who were considered to be knowledgeable about the IK of the community. The study was conducted from June 2013 to January, 2015**.** Moreover, data collection, analysis and interpretation were done by the researchers.

Study participants, and method of sampling

This study was done by taking sample units of 55 participants and all of them were native individuals of the Zeyse, Zergulla and Ganta communities. Method of the study was qualitative design involving purposive sampling method and the key informants from each community were particularly relevant to the data collection based on the research objectives.

Methods of data collection

Preliminary survey including legal attachment with concerned zonal administration and Kebele representatives, pilot study survey was conducted. Pilot study was targeted to avoid unnecessary repetitions/redundancy of the questionnaire/, to assess both external and internal intervening factors, effective utilization of man power and budget (Figure 2).

Instrument used to collect data for this study was Focus Group Discussion (FGD) which covered themes on the values of biodiversity, its current status and biodiversity conservation using

Figure 2. Group discussion during the pilot study.

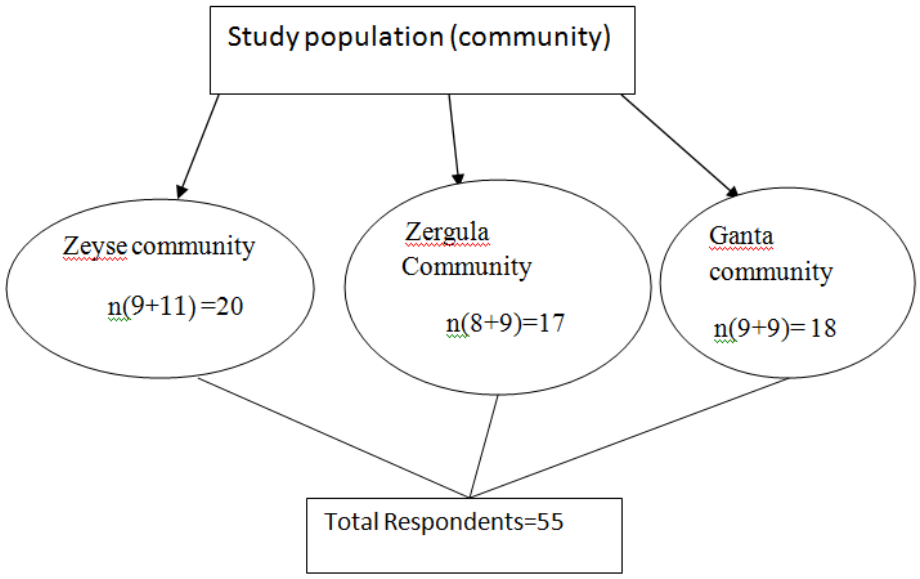

Figure 3. Schematic presentation of the sampling design.

indigenous knowledge system. The researchers had FGD with a total of fifty five persons including adults and community elders (Figure 3) expected to know the traditional/cultural practices of their communities. The discussants were categorized into six FGD groups (Age: 30-120), consisting of eight to eleven individuals including both sexes. The choice was purposeful selection because community adults and elders have a better traditional knowledge/ knowledgeable on biodiversity conservation (‘‘In Africa, when an old person who is expertise of IK dies, it is like when a library burns down.”).

Moreover, questionnaire were also exposed to all participants to collect data on age, occupations, skills, Zonal, Woreda and Kebele

Table 1. Gender and age range of the respondents.

S/N	Items	Male/Female	Age range	Total	Frequency (%)
1	Gender	Male	30-40	4	7.2
			41-50	7	12.7
			51-60	13	23.6
			61-70	14	25.5
			71-80	7	12.7
			81-90	5	9.1
.			90-100	1	1.8
			101-110	0	-
			111-120	2	3.6
2		Female	41-50	2	3.6
		Total		55	100

addresses. During discussion on each item, the respondents were free to express their views with no intervention/limitation or no leading ideas/ clues were given to the respondents.

Data analysis

Responses of the FGD respondents were collected and interpreted using qualitative method of the research involving language oriented approach based on thorough descriptions and inter-pretations of indigenous knowledge and its role in biodiversity conservation within the communities.

Ethical consideration

Due to ethical reasons, researchers did not interfere directly into the privacy of the community. We made formal attachment with zonal and Woreda development office of the Agriculture and legal attachment was also done with kebele administrations. Moreover, individuals involved in the data collection process were given verbal consent and validity of the study was clearly explained to them as a prerequisite before the data collection.

RESULTS

Background information about the respondents

A total of 55 respondents of the community adults and elders, including both genders (males = 53(96.3%, Females = 2(3.7%) were included in the study and their background information was shown in Table 1. In Table 1, respondents' age grade indicated age variations (minimum age = 30, maximum age = 120) of adults and elders who participated during the FGD.

Values of Biodiversity and its current status

This survey showed different values of biodiversity for life supporting/ livelihood of the indigenous people of local inhabitants (Zeyse, Zergula and Ganta communities).

The case of Ganta community

The respondents from Ganta community reflected, values of biodiversity which included: ''Household materials including tables, chairs and house construction (e.g. *Juniperus procera*is a termite resistant and is used for the traditional house construction including its pillars). Trees and forests are used as a home- place for wild animal's protection from sun rays, and biological enemies. Grasses can be used as fodder for domestic animals, and bamboo plant (*Arundinaria alpine k*Sch.m.) has so many uses for the community (Figure 4). Other uses of plants for example: woods of *Cordia africana*, *Croton macrostachyus* Del. and *Olea europaea* subsp. Cuspidata L. were used for our local house construction, and making household furniture. On the other hand, domestic animals such as horses, donkeys and mules are used for loading goods; cattle are used for ploughing, meat and milk production used as a source of nutrient, and for income generating activity etc to support our livelihood.''

Bamboo plant (*Arundinaria alpine k.Schum (Dusha local name*)

1. Is native to Gamo highlands including Gantameyche.
2. Uses of bamboo plant includes: house and, fence construction, making beehive, toothbrush, house decoration, basket, materials used for feeding, leaves are used as fodder for cattle, preventing soil and water erosion.
3. Used as a totemic item (object associated with worship) etc to support the livelihood of the community'' (Figure 4).

The case of Zeyse community:

Respondents of the Focus group Discussion (Figure 5)

Figure 4. Bamboo plant as part of plant biodiversity, provides support for the livelihood of the community.

Figure 5. Respondents involved in Focus group discussion at Zeyse Kebele.

Zeyse community described the following values of the biodiversity for the livelihood of the community: As reflected by the respondents ‘‘Variety of lives (plants and animals), have a lot of advantages for the livelihood of our community including: Protection of human as well as animals. E.g. during the Italian invasion, forests played a greater role for the protection and strategic offensive activities, that is, humans and animals used forests to hide themselves from their biological enemies, forests are used for ecological balance, woods of trees for house construction (e.g. woods of *Juniperus procera* and *Olea europaea* subsp.Cuspidata L. are resistant to termites and are used for the construction of traditional houses including pillars of the houses).

Woods of Plants/ trees are also used for making house goods such as chairs, stools, locally made bed (*digo), horse reddish tree (Moringa stenopetala L.)* is used by the community as a source of food and remedy for coughing and the plant is shown in Figure 6. Domestic animals including horses, donkeys and mules are used for loading goods; cattle are used for meat and milk consumption, ploughing, and income generating activity’’ etc. to support our livelihood.

Horse reddish tree/Moringa stenopetala L./ (Local name: Talahae)

1. Elders claimed ‘‘this *plant was Native to Zeyse Wozaka kebele, and had been spread later on to the*

Figure 6. Horse reddish tree as part of plant biodiversity and its holistic use for the livelihood of the community.

proximate communities including Derashe and Konso communities.*"*(= the diameter of the plant stem in Figure 6).
2. Leaves are used by the community as cultural daily food and remedy for coughing.
3. Roots are used to treat malaria and purify water
4. Resists drought used as shade
5. Used as a daily food source for the whole year'' by the community (Figures 6 and 7)

The case of Zargula community

Respondents of the FGD (Figure 8), Zergula community reflected the following values of biodiversity for the livelihood of the community, that is, ''Domestic animals including horses, donkeys and mules are used for loading goods; cattle are used for ploughing, income generating activity, and nutrients for humans. Wood of trees are used for construction of houses and house goods (chairs and tables), fire wood and grasses are used, for house construction and fodder for grazing animals and all of them support our livelihood.

Current status of plants and animals biodiversity

Respondents from each community reflected the following current status of biodiversity.

The case of Ganta community

Respondents from *Ganta* community described ''currently biodiversity (plants and animals biodiversity) were eroding, that is, ''There were trees and grasses that became extinct, regardless of our domestic usage. Some examples of wild animals disappeared from our area

Figure 7. Edible Leaves of *Horse reddish tree***/**cabbage-tree**/** and banana plant used for the livelihood of the community.

included *Garma (Pantheraleo)*, *Tolko* (*Crowta otocelta*) due to deforestation, *Doa* (*Tragelaphus strepsoceros)*, *Feletso (Traglaphus imberbis)*and *Urdyle (Syivicapra grimmia)* due to illegal hunting and birds such as *Kuro* (*Corvus albus*/the Ethiopian crow spp.), *Tsilo* (Eagle species), and *Anko* (*Necrosyrtesss monachus)* were reduced in number. Some plants such as *Bobile (Cordia africana Lam.), Ule (Olea europaea subsp.)* and *Boro (Erythrina brucei)* were lost due to deforestation. During these days, we do not even hear the sound of a lion, and a hyena in our area.''

Currently, why is biodiversity eroding?Respondents from the *Ganta* community reported their views on this question, that is:

1. ''Forests including sacred trees were indiscriminately being cut down for the construction purposes.
2. Due to impacts of religion on our traditional belief to protect sacred trees. One of the respondents described'' No sacred trees ever exist according to the protestant religion.''
3. Our children were influenced by the effect of globalization and were resistant to our tradition and belief system of conservation. Therefore, in short, our IK and biodiversity were eroding during these days (currently) because:

1. Wild animals were lost because, our tradition to protect animals was lost, that is, community norms, and customs to protect animals were lost.
2. We did not protect the tradition of our grandparents which allowed us to protect our nature including wildlife.
3. Due to loss of animals, we lost productivity and blessing.
4. Population pressure had also impacts on the loss of animals.''

The case of Zayse community

Respondents from Zeyse community also reflected the loss of biodiversity (plants and animals) by stating ''loss of our culture to conserve nature, led to loss of our ownership of the natural resources including the wildlife (plants and animals). The loss of our culture to conserve nature led to loss of our IK to protect animals and plants.''

''Some examples of animals and plants species which were lost from our area due to deforestation including: *Osso* (*Diceros bicornis*), *Zaka* (*Laxodonta africana*), *Meno* (*Syncerus caffer*), and animals that were reduced in number included *Gaash (Hyiochoerus meinertzhageni*), *Doge* (*Kobusellipsiprymnus defassa*), *Doa (Tragelaphus scriptus), Agazene* (*Antelope* species) *peletso* (*Traglaphusim berbis*) *Garma* (*Panthera leo*) and *urdyle (Syiviapra grimmia)*. Some plant species included *Galma* (*Cordia Africana Lam.*), *Demo* (local), Witse (local), *Gulta* (*Olea europaea* subsp.Cuspidata L.) *Salbena* (local), *Bibre* (*Junipers procera Hochestex. Engl.*) were dwindling in number, and *Sabune* (local) was lost from the area due to deforestation.''

Why is biodiversity currently eroding? Respondents from the *Zeyse* community reported their views on this question. ''Whenever, there was a forest, the probability of rainfall was higher. If forests were lost, how would we domesticate our animals to get our daily requirements including, flesh, milk, meat and skin/hide? One of the respondents also explained his observation by saying ''historically, starting from the king Menilik up to military government, protection of forests was fairly good and better attention was given to this mission. However, currently, "Everybody is indiscriminately cutting trees including the sacred trees' and even when the action taker was asked why he/she was doing so? The answer would be short ''it is my right to do so'' with no limitation. This act also reminded us'' when the tradition of a community to preserve nature is lost, generation who inherits, it is lost' (that is, no proper pass over of our custom of conservation to new generation) leading to loss of our natural resources including biodiversity. Currently, our boarder is not protected or even being invaded by some people from the proximate area of *Zeyse* indigenous people. These infiltrators, illegally cut down trees, using our land forfarming, destroying our forests including sacred trees, forests at the tomb sites, and consequently animals escaped away.''

Moreover, the respondents also said ''when the culture

Figure 8. Respondents of the *Zergula* Community involved in Focus Group Discussion.

embodying IK to protect wildlife is lost, system of transmitting IK to new generation would be lost. We also tried to advise our youngsters not to cut trees indiscriminately, but they are resistant to accept advice of community elders. When we reported the illegal activities against our forests and wild animals, no legal measures were taken against the infiltrators''. One of the respondents also explained the best episode which was happened during the past 'regime' by saying "If a person cut a tree illegally, he was ordered to plant the tree again in compensation", and this action was a good experience for us today. Therefore, currently we experience land ownership problem due to infiltrators and this also affected our culture of biodiversity conservation.'' We had a better culture of biodiversity conservation in the past vis-à-vis the present time.''

The case of Zergula community

The respondents from *Zergula* community also described current loss of biodiversity by considering some examples of wildlife. ''Currently due to weak biodiversity conservation, plants including: *Och* (*Syzgium guineense* Dc*.), Galunda* (local), *Ele* (local), *Bulo* (*Solanium marginatum*L.f), *Gurdade* (*Capparis decidua*), *Gerea* (Local), *Ambe* (local) and animals including *Urdo (Sylvicapra grimmia*), *Garma (Panthera leo*), *Aka* (*Guinea fowl species), Gabora* (*Traglaphus scriptus*), *Meno (Synceruscaffer*),*Dereanko*(*Necrosyrtesmonachus*),*Agaz ane*(*Antelope* species), *Osso* (*Diceros bicornis, Faro* (*Equus burchelli*), *Kulo* (*Francolinus species*), *Mahae* (*Panthera paradus)* and *Feletso* (*Tragelaphus imberbis)* were present in the past, but now they are absent.''

Why is biodiversity currently eroding? Respondents from the *Zergula* community reported their views on this question as described below by stating'' it is due to a loss of our culture to protect wildlife and population pressure, why our traditional values were being broken. The respondents also analysed the status of biodiversity by comparing biodiversity conservation of the past Vis-a- Vis the present by describing, 'Nobody attempted to cut trees unless it was allowed by the *Kat* (community leader), but currently, a person cuts trees as he wishes. We used to plant trees and protect our natural resources, but currently, our land is taken away by the flood (soil erosion). When there were forests, there were wild animals, but now forests are lost, and wild animals were either disappeared or lost or escaped to kola of "*Zala* desert.

In the past, ''community properties including forest and other personal properties were not affected or lost; all were protected, maintained or conserved and so is true for the plants and animals biodiversity. But these days, this traditional holistic ethics to protect our wildlife had become a history and youngsters do not listen to elders to use our IK to protect our wildlife.''

Biodiversity conservation using indigenous knowledge

The case of Ganta community

Respondents from the ***Ganta*** community described, biodiversity conservation using IK indicated as follows:

1.''Community had a strong traditional law/custom and a person who cuts trees or commits mistake or suspected being disobedient against traditional law/custom was punished by '*Maga*' (traditional leader of the kebele) because, people used to consider this act as illegal and the individuals would be disobedient. Furthermore, if the individuals were suspected of being disobedient against traditional law/ custom, he/she would be condemned and cursed.
2. Moreover, places of tomb sites were considered as taboos and trees including sacred trees were not cut down from these areas.
3. Assistant of " *Maga*" named as '*Demusa*' was used to conduct a proactive measure involving erecting totemic items' (objects associated with worship) such as bamboo plant or a bush tree with many branches or runners (serdo) at the site, which needs protection and this act was called a *Zir* (locally) according to a community custom. When a '*Zire*" was done, at a site which would be protected, nobody would act against the will of the community such as cutting trees, stealing the property of others. According to this custom, even lions and tigers were not killed. Therefore, any individual from *Meychekebele* did not dare to cut a tree from that of the *Bonkekebele* and vice versa (*Meyche* and *Bonke*are two kebeles of *Ganta* community) and this traditional measure was the basis for the protection of the forests.

Respondents also reflected the following traditional ways of specific measures against the illegal actors:

1. If lions were killed, *kanchememaga* was used to order the lion to kill the individual, who killed the lion.
2. *"Gero Kat*" was used to order lions to eat cattle of a person, whose cattle ate somebody's crops.
3. ''Ela*maga''* was used to order owls not to be killed because, this bird was considered as a messenger of the community (predicts the death of an individual).
4. Locusts were ordered to eat crops of individual, who made mistake against the tradition/custom of the community.

The respondents also agreed on the following points: '' we must: 1. protect the remaining animals and never kill animals. 2. We need to cover degraded and bare mountainous area by plantation, which needs support from the government. 3. Preserve our culture to protect our biodiversity.

The case of Zeyse community

Respondents from *Zeyse* community described, that they had a strong traditional law/ custom to protect forests and wild animals which was performed and guided by the active involvement of the kebele leaders called '*Mega* and *Chima (*elders) of the community. Accordingly: (i) ''Community used to consider, cutting trees from the burial area (tomb sites) (= e.g. *zhosha* burial site), as taboos because these places were considered as'' sacred areas'' where the spirit of ancestors were used to rest. (ii) Community leader (*Kat)* used to give, proactive, protective orders to community to maintain and protect forests, grasses and wildlife, and their boarder including their natural resources. For this purpose "*Maga*" used to slaughter a sheep or a goat as a sacrifice at the site, of protection as a religious ceremony/ ritual ceremony) for the ancestral spirits. Example, Goat was slaughtered as a sacrifice for this purpose between the boarder of *Zeyse* and *Ganta* community. *Kolta* hills were also considered as sacred hills where cattle were slaughtered for the ancestral spirits. This religious ceremony/ ritual ceremony was aimed at, for the prediction of good fate for the community, to safeguard the boarder,(= maintain safety of the boarder including natural resources), and for the prosperity of the community, so that nobody would dare to infiltrate into *Zeyse* boarder, and cut trees, kill animals, expand boarder and invade other properties. (iii) According to the tradition of the indigenous *Zeyse* people, there were animals and plants which were considered as cultural taboo (never be killed or touched or cut down) due to affection and beliefs towards nature, that is, some examples were:

1. There was a bird (locally named "*solo"*) which was immune to killing because it was considered/believed as *kat* of birds (=king of birds)and the feather of this bird was used:

a. During the burial ceremony of a *kat (*leader of the community*)*, as a symbolic sign on the head of mourners to give a special attention and an honour for the death of a *Kat.*
b. To indicate succession of *kat*'s son and for this ceremony, the feather of a''Solo'' was erected on the hair of the successor. Anybody who killed 'solo' was forced to pay compensation fee for the "*Kat*" of the community.
2. Nobody used to kill a mammal called "*Dul-o* due to cultural reasons ''but, if somebody used to kill it unknowingly, its skin should be given to the *Kat* and get excuse and blessing from the "*Kat*" of the community.
3. Nobody was allowed to kill *Gutus* (Ethiopian owl spp.), because it predicts the death of an individual. A person who used to kill *Gutus, leader of the kilan* would roll the seeds of *bulo (Solanum marginatum L.f)* around the killer's head as an excuse before entering to his house to be saved.
4. *Dobes'* (*phyton sabae*) immune to killing because, phyton was considered to be the king of snakes (*shosh kat*).
5. *Badite* (*Croton macrostachyus* Del): nobody was allowed to cut this plant because community considers this tree as a holy tree (totemic symbol), because the root and the leaf ofthis tree were used by the *Kat*and *Maga*to solve individuals and community problems.

"When culture embodying indigenous knowledge is lost, generation is lost, causing biodiversity loss." Therefore, the respondents agreed (to): ''Be a guard for the protection of culture to preserve forests and animals through the following:

1. Plant trees, three times than usual and give protection for wild life.
2. Biodiversity (wildlife diversity) can be protected and sustained, only, if we protect our culture embodying our IK.
3. Have boarder and our boarder must be protected, so as to maintain our ownership and protect our natural resources including wildlife (animals and plants).
4. Practice "green development" and "Protect culture to protect biodiversity."

The case of Zergula community

Respondents of the Zergula community explained, biodiversity conservation using IK by stating ''Traditional tomb sites (burial area) of the community were considered as taboo sites, that is, not only cutting trees were forbidden, but also nobody is allowed to look at and enter illegally into the sites of the tomb.

There were 12 kebele leaders (*Magas)* under one community leader (*Kat*) who were used to conduct a ritual ceremony at worshiping sites between the boarders of each kebele. They used a sacrifice of cattle to predict good fate for the community including productivity, healthy child growth, blessing and prosperity for the community. In these areas, forests were maintained and considered to be taboos and nobody attempted to cut trees down, because they were the resting site for the ancestral spirits.''

''Community also had a belief that *"Kat*" had a power to cause rainfall (rainmaking power) and for the feasibility of this belief, '*Kat*' was used to pray to cause rainfall for the Community. When there was no rainfall, community gather together with "*Maga* and community elders (*chima*) and used to shout/report to the *'Kat.* 'The *Kat used to* conduct a ritual ceremony in a ''clean selected area and say' *'Let you prey and I would*' prey, to god which caused rainfall, and this assisted biodiversity conservation''.

Respondents also reported that ''anybody who used to breach traditional customs and attempt to steal, and cut trees would become sick and mad. If a person used to breach custom of a community**,** *Kat* used to order a snake to bite custom breaker/ traditional law breaker to maintain law and order of the community. Respondents also reflected that community had a culture of succession to conserve wildlife and nature, but currently youngsters are resistant to accept this tradition. Therefore, we need to'' teach our children formally at school level and informally at home to protect our culture embodying IK to conserve our wildlife.''

DISCUSSION

Use of biodiversity for the livelihood of the community

This research investigated, the values of biodiversity, its past vis-à-vis the current status, and biodiversity conservation using indigenous knowledge of Zeyse, Zergula, and Ganta communities. All respondents from each community reflected the holistic values of biodiversity for the livelihood of the community.

This results agreed with other similar study results on many traditional societies over the world, which indicate a wide range of values of biodiversity including, a large number of plant species from the forests are used for food, fibre, shelter or medicine (Anthwal et al., 2006), forest has been the main source of plant materials used for household materials by various people in the World and about 80% of Africans depend on forest resources for shelter, medicine, rural architecture and engineering for their survival (WHO, 2010).

Moreover, another similar study also reflected, the value of biodiversity as indigenous cultures, sometimes recognize biodiversity's value in religious traditions based on honouring the Earth and proximity to nature, which has also been shown to enhance emotional and spiritual well-being (Atkinson et al., 2012). Atkinson et al. (2012), also explains, cultural ecosystem services include use-related values such as leisure and recreation, aesthetic and inspirational benefits, spiritual and religious benefits, community benefits, education and ecological knowledge, and physical and mental health.

Our study results, indicated, *Arundinaria alpine k* (locally *Dusha*) and *Moringa stenopetala (locally Talahae)* were considered as the explanatory component of plant biodiversity and their values for the livelihood of Ganta and *Zeyse* communities as indicated in Figures 4, 5 and 6, respectively were considered as asset for the indigenous people in the study areas.

This study showed the uses of*Arundinaria alpine k* at low scale level. However, our result was in conformity with the use of *Arundinaria alpine k* worldwide except Europe (Okumura et al., 2011). However, more research is needed to increase the knowledge on *Arundinaria alpine k* (Mazzini, 2006, cited in Okumura, 2011; Okumura, 2011) and its utilization including in Africa in general and Ethiopia in Particular.

This study also indicated diverse value of *Moringa stenopetala* (locally *Talahae*) (Figures 6 and 7) for the livelihood of *Zeyse* community. This result were inconformity with other study result on ''Nutritional and therapeutic role of *Moringa stenopetala* which states that traditional communities use the plant for multiple purposes such as source of food and medicine and the species is quite drought resistant (Mohammed, 2013). Moreover, the Njemb tribe, living in Kenya also utilizes this tree as medicinal plant (Berger et al., 1984).

Another study shows leaves are one of the best vegetable foods that can be found in the locality. In fact, all parts of the tree except the wood are edible, providing a highly nutritious food for both humans and animals (Padayachee and Baijnath, 2012). It was also reported that *Moringa stenopetala* foliage/leaf and fruit pods are rich sources of calcium, potassium, zink, and iron, and good sources of vitamins A, B, and C as well as sulphur-containing amino acids, methionine, cystine and a high percentage of carbohydrate (Abuye et al., 2003; Yisehak et al., 2011 cited in Mohammed, 2013). However, studies also indicate the presence of small amount of cyanogenic glucosides in *M. stenopetala* leaves may have a health risk in areas of high incidence of endemic goitre as an exacerbating factor if consumed more for a long period of time (Abuye et al., 2003). Therefore, still the overall values and demerits of the plant on health needs further studies.

Furthermore, Elders of the *Zeyse* community claimed that ''this plant was Native to *Zeyse Wozaka* kebele, and has been spread/cultivated, later on to the proximate communities including *Derashe* and *Konso*. ''Furthermore, elders of the community as a proof described'' Long years ago, the Leaf of *Moringa stenopetala was named as ''Duts'eMagaMisAbulo''* by the *DutseMagaMaldo (Maldo was the leader of Dutse tribe in Zeyse).* After naming the plant for the first time, *MagaMaldo,* consumed the leaf first time and allowed the community to eat the leaf of *Moringa stenopetala* (Abayneh, 2007). Therefore, though, *M. stenopetala* is endemic to east African countries mainly Ethiopia (South) and North Kenya (Abuye et al., 2003; Mohammed, 2013), still the origin of this plant in Ethiopia particularly in southern regions needs further study/investigation.

In relation to our study on values of biodiversity, other studies related to ecosystems also show many services to sustain human health such as nutrition, regulation of vector-borne disease, or water purification, and natural settings that could act as a catalyst for healthy behaviours. This leads to increase physical exercise, which affect both physical and mental health (Pretty et al., 2005; Barton and Pretty, 2010). Besides, simple exposure to the natural environment, such as having a view of a tree or grass from a window, can be beneficial, improving mental health status (Pretty et al., 2005). Therefore, these wide spectrum values of ecosystems indicate a wide scope of biodiversity uses for the livelihood of the community in general and communities in the study areas in particular.

Current status of biodiversity

This study also assessed current status of biodiversity vis-à-vis the past and the result showed biodiversity is eroding/dwindling in the study areas, that is, trees and grasses became reduced in number or became extinct, regardless of their domestic usage, plants and wild animals disappeared due to deforestation, and illegal hunting and birds were reduced in number during these days.

This result was in conformity with another study which describes recent times, extinction rates are ten to hundred times higher than during pre-human times (Sinclair, 2000a). Moreover, a study carried out in Ethiopia shows loss of Forests, Grasslands, and Drylands that indicates the loss of biodiversity indicates only a 4% forest cover and an estimated deforestation rate of 8percent per year as of 2000 (World Resources Institute: Earth Trends: Forests, Grasslands, and Drylands,(2003) cited in USAID, 2008), and this result supports our present findings.

Our study result also showed hunting in the areas was one of the reasons why animals were disappearing and this result was in agreement with similar study which explains, increased illegal hunting continues to be a major threat to forest biodiversity in many countries and the depletion of wildlife is intimately linked to the food security and livelihood of numerous tropical forest-region inhabitants (Nasi et al., 2008).

Our study results of current status of biodiversity vis-à-vis the past showed indigenous knowledge and biodiversity were eroding currently because; our tradition of wildlife protection was lost. For example: Sacred trees and trees growing at the tomb sites were cut down indiscriminately for the different purposes including construction. Our custom and belief system of conservation of wildlife, using IK was lost''. Moreover, one of the respondents also explained his observation by saying '' in the past, protection of forests were fairly good and better attention was given to this mission. 'Moreover, the respondents also said ''when the culture embodying IK protecting wildlife was lost, system of transmitting IK to new generation would be lost'. One of the respondents also explained the best episode which was happened during the past regime' by saying "If a person cut a tree illegally, he was ordered to plant the tree again in compensation", and this action was a good experience to save our forests including biodiversity.

Our results were in conformity with similar study conducted on biodiversity analysis, which states threats to Ethiopia's biodiversity, and tropical forests including, population growth/pressure, land degradation, weak cultural and modern management of forests and deforestation (USAID, 2008*).* This study also supports efforts to extend tenure or community use rights of land to forest areas, thereby encouraging the sustainable use and management of forest resources (USAID, 2008*).*

Our result also indicated that indigenous knowledge has a holistic purposes and this result was in line with similar study which states indigenous knowledge is intricately linked to the practical needs of use and management of local ecosystems and loss of this system caused biodiversity loss (Toledo, 1992).

In relation to our study results, different studies and

declarations also show the ties between culture and biodiversity loss. According to Martin (2008), culture and nature have co-evolved over time to become intertwined and mutually dependent. ‘’When we lose one, we lose the other. Moreover, there is an inextricable link between cultural and biological diversity" (Belem Declaration, 1988). When this inextricable link” between people and the environment begins to break down and if people are displaced, or if their “place” and their way of life are radically transformed, people’s place-based values, knowledge, and behaviours begin to lose their significance (Maffi, 2010).

Furthermore, United Nation Declaration on the Rights of Indigenous People states ‘’ indigenous peoples have the right to the conservation and protection of their environment and productive capacity of their lands or territories and resources. Moreover, States shall establish and implement assistance program for the Indigenous Peoples for such conservation and protection without discrimination’’ (UN, 2007).

Therefore, indigenous people of the community in general, and that of the study areas in particularare the owner of their environment and need to protect and conserve their land including natural resources and biodiversity as part of their cultural values ((UN, 2007). Thus, this result indicated loss of biodiversity is a significant threat to the livelihood of the community in general and Zeyse, Zergula and Ganta communities in particular and hence needs greater attention of the community and the government.

Biodiversity conservation using indigenous knowledge

Our result showed biodiversity Conservation Using Indigenous Knowledge of each community included, strong traditional law/ custom, which considered trees oftomb sites and sacred trees as taboos which were not cut down from these areas, animals and plants were considered as cultural taboos (never be killed or touched or cut down) due to affection and beliefs towards nature, and communities had a custom of empowering indigenous people and community leaders and elders. For example, *Maga”* used to conduct proactive protective measures involving’ erecting totemicitems to protect cutting trees, killing animals (wildlife), and stealing the property of others. Moreover, community had a tradition that *Maga/Kat* had a power to order lions/snake to punish illegal individuals.

In support of our findings, similar study results show, some forests were protected by IK beliefs such as taboos that forbade people to enter them and some trees were declared as sacred and felling them constituted as a breach of taboo and virtually remained untouched for generations’ and they stand out as ecological museums of local vegetation (Laurel and Nyberg, 2000). Other recent study also shows, traditions, customs, beliefs and cultural rights play an important role in environmental conservation and biodiversity of the South and South west regions of Cameroon (Fongod et al., 2014).

Moreover, another study also shows all forms of vegetation in the sacred groves are supposed to be under the protection of the reigning deity of that grove, and the removal of even a small twig is taboo (Vartak and Gadgil, 1973 cited in Anthwal et al., 2006). In addition, sacred groves are one of the first instances of traditional conservation and nature worship has been a key force of shaping the human attitudes towards conservation and sustainable utilization of natural resources (Anthwal et al., 2006).

Furthermore, in conformity with our study result, another study also indicates affection towards nature was a zoolatry (worshipping of animals), totem (considering plants and animals sacred), *etc*, which in turn led to a sort of prudent conservation(Anthwal et al., 2006).

Our study result also indicated, all respondents expressed their genuine and ownership concern how to conserve their culture and biodiversity using their indigenous knowledge, but traditional way of biodiversity conservation using indigenous knowledge was hidden and being eroded due to weak transmission of culture to new generation.

In line with our study, similar studies show, the effective contributions of the indigenous people using their indigenous knowledge to forest conservation (Anthwal et al., 2006). However, in a paradoxical way, indigenous people have been ignored or less attention it was given, to their IK, even though they control most of the natural forest areas either consciously or unconsciously through their traditional practices, with strong conservation ethics (Babu, 1991; Daou, 2000; Advice, 2009). Moreover, another study also reveals that Indigenous Knowledge continues to be marginalized in development plans, and this has resulted in its limited use in the development process (Ocholla, 2007). Therefore, this basic human asset needs greater attention.

CONCLUSION AND RECOMMENDATIONS

Respondents from Zeyse, Ganta and Zergula communities described their future concern about biodiversity conservation using indigenous knowledge “When our culture embodying indigenous knowledge is lost, generation would be lost, causing biodiversity loss.” Therefore, we would/should: ‘’Be a guard for the protection of our indigenous knowledge to preserve the remaining forests through the following:

1. Plant trees three times than usual and give protection for wildlife.
2. Protect biodiversity in a sustainable way, only, if we protect our culture.
3. Maintain our ownership on our boarder and protect our natural resources including wildlife (animals and plants).

4. Cover degraded and bare mountainous area by plantation, which needs support from the government.
5. Teach our children formally at school level and informally at hometo protect our wildlife''.

Based on the findings, authors recommend:

1. Biodiversity has fundamental values to humans, because we are dependent on it for our nutritional, cultural, economic, and environmental/ecological well-being. Therefore, it is our moral responsibility to conserve the Earth's incredible biodiversity for our well-being and for our next generations.
2. Indigenous knowledge has a holistic nature because it is intricately linked to the practical needs of use and management of local ecosystems by the indigenous people.
Therefore, we need to:

(a) Recognize indigenous knowledge of the community to protect our culture and biodiversity.
(b) Protection of culture, nature and biodiversity are inseparable, because they have co-evolved over time to become mutually dependent. ''When we lose one, we lose the other''.
(c) To conserve biodiversity effectively, indigenous people need empowerment, and recognition of their knowledge in their own territories.
(d) Assign indigenous rights to land tenure, access resources and strengthen cultural integrity (Sobrevila, 2008).
(e) We need a holistic and integrated knowledge systems including IK and modern knowledge (should complement each other) to conserve biodiversity in a sustainable way.
(f) University scholars need to work on this agenda to end up with sustainable biodiversity conservation and development.

Conflict of Interests

The authors have not declared any conflict on interests.

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