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The substantial potentials for establishment of biosphere reserve in the Afar Region, Ethiopia

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The Afar region is endowed with rich and diverse natural and cultural resources that have outstanding universal values from the perspective of culture and biodiversity conservation and it plays significant role in maintaining the arid and semi-arid part of the country. Moreover, there are considerable ecological and socio-economic opportunities in the region to enhance sustainable development as well as long-term research. Several literature resources that include academic publications, and policy and strategy documents were examined to explore and document the existing potentials of the Afar Region for the establishment of biosphere reserve. From the review, it was concluded that the Afar Region is endowed with rich and diverse natural and cultural resources that have outstanding universal values from the perspective of conservation of biodiversity and culture, sustainable development, and scientific research and monitoring. Thus, the region has significant areas that well fulfill the basic functions and criteria for designation of Biosphere Reserve but not yet represented in similar scheme of conservation area. It is therefore recommended to address the existing gaps and establish biosphere reserves in the region following the basic principles and criteria for designation of such schemes of conservation areas.

Key words: Biosphere reserve, criteria, function, conservation, sustainable development.

INTRODUCTION

The Afar triangle, situated in the Great Rift Valley is named after the Afar people, which are the prominent inhabitants of the region. The Afars are politically dispersed in Ethiopia, Eritrea, and Djibouti. In Ethiopia, they now inhabit the north eastern lowland, which is now delineated as Afar National Regional State (ANRS, 2000; Gebretensae, 2004; BOPRD, 2008).

Like other pastoralist in Africa, the Afar people largely adhere to clan-based natural resource management system in which the local communities are empowered to

manage the natural resources for communal benefits. Pastoral territories are composed of several different elements, including grass, shrubs and trees, surface and sub-surface water, different types of salt deposits, wild animals and other useful resources (IUCN, 1989; Gebretensae, 2004). In the Afar Society, the utilization of important natural resources such as wet and dry season grazing lands, water and trees has rules (ANRS, 2000; Gebretensae, 2004; Scott, 2019; FDRE, 2022).

The Afar region has a rich cultural heritage that ranges

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from a fascinating history to traditions of cohesive and well-organized social systems. It is a location for spectacular and historic landforms, characterized by volcanic activities, which consists of volcanic cones, lakes, rivers, hot springs and calderas with active vents (Cavalazzi et al., 2019; Otálora et al., 2022).

The findings from the internationally known archaeological and paleontological sites of the region not only reflect the culture of the first tool-making hominid but also indicate that the region was inhabited since ancient time of human history (WoldeGabriel et al., 2000; Alemseged et al., 2005; Alemseged et al., 2006; ARCCH, 2016). The historical and social settings of the Afar society, which are linked to their culture, exhibit an important interchange of human values. On the other hand, these values play significant role in the management of natural resources and hence ensure biodiversity conservation. Thus, the values embodied in the Afars' integrated culture have an outstanding universal value in ensuring wise use of the environment (Gebretensae, 2004; Balehegn et al., 2019; Balehegn, 2020). In general, these globally substantial values make the region a significant Biosphere Reserve where humans, biodiversity and their ecology as well as sustainable development are evident. Despite this fact, the region is not yet represented in similar scheme of conservation area of Ethiopia. Therefore, this review aims to explore and document the existing potentials of the Afar Region for the establishment of biosphere reserve.

LITERATURE SOURCES AND STUDY SCHEME

This review used several resources that include academic publications, and policy and strategy documents related to the Afar Region and Biosphere Reserve. The Biosphere Reserves – the Seville Strategy and the Statutory Framework of the World Network (The United Nations Educational, Scientific and Cultural Organization - UNESCO, 1996), the Biosphere Reserve Nomination Form (UNESCO, 2013a), the Periodic Review for Biosphere Reserve (UNESCO, 2013b), the new Roadmap for the Man and the Biosphere (MAB) Programme and its World Network of Biosphere Reserves (UNESCO, 2017), and the Technical Guidelines for Biosphere Reserves (UNESCO, 2021) are the main documents that were assessed for this study. Moreover, a total of 64 published articles and books have been examined for the review. In the case of sources that are not available in local libraries and archives, Google Scholar (<http://scholar.google.com>), Science Gate (<https://www.sciencegate.app>) and Science Direct (<https://www.sciencedirect.com>) as well as the UNESCO Man and Biosphere Programme (MAB) website (<https://en.unesco.org/mab>) were the academic search engines and websites used as options. Keywords such as criteria, Biosphere Reserve, Afar region, Afar values were used to search the literatures. In general, the study used the steps and procedures shown in Figure 2.

STUDY AREA

This review mainly deals with the existing potentials of the Afar region for designation of biosphere reserve. The Afar region is situated in the north eastern part of Ethiopia and has an area of about 94,760 km² (Figure 1). This area of the regional state accounts for 8.4% of the area of the country, Ethiopia (BOPRD, 2008; Biru et al., 2010).

The Afar National Regional State is found at the core area of the northern Great Rift Valley System of Ethiopia. The altitude of the region ranges from 120 m below sea level at the Danakil depression (where one of the highest temperatures on Earth has been recorded) to about 1600 m above sea level in the hilly escarpments of the western and southern edges. The highest peak, mount Mussa-Alle is just 2063 m above sea level (ARCCH, 2016). The region's temperatures and rainfall vary depending on the altitude and habitat. The temperature of Afar varies from 25°C during the rainy season (September-March) to 48°C during the dry season (March-September) (Gibson, 1967; Biza, 2014; Ilsley-Kemp, 2018; Fenta et al., 2019). The Afar Regional State has a population of 1,812,002 according to the Central Statistical Agency of Ethiopia's projections for 2017 (the most recent official census was in 2007), of which 1,466,000 (or around 90% of the population) are pastoralists. The others are agro-pastoralists, a relatively new lifestyle supported by the government in collaboration with partners in an effort to lessen pastoralists' reliance on raising animals (BOPRD, 2008; Scott, 2019). The herding and husbandry of domesticated animals, especially in the case of Afar Pastoralists, goats, sheep, cattle, and camels, is central to their culture and means of subsistence (Scott, 2019; Balehegn et al., 2019; Balehegn, 2020; FDRE, 2022; Burka et al., 2023).

RESULTS AND DISCUSSION

This study which invites further analytical research will be specifically geared to examining the rich and diverse natural and cultural resources of the Afar Region that have outstanding universal values from the perspective of conservation of biodiversity and culture, sustainable development, and scientific research and monitoring. Thus, it is limited to assessing the areas in the region from the perspective of requirements for designation of biosphere reserve and the basic principles and criteria in this regard are discussed in the following.

Existing conducive conditions for the three main functions of biosphere reserve

Biosphere reserves have three basic functions which are mutually complementary and equally important. These are: (1) conservation of biodiversity and functioning ecosystems including the cultural diversity; (2) sustainable development; and (3) logistic support which means mainly research, monitoring and education (UNESCO, 2013a; UNESCO, 2021). In some cases of African context, 'participation' is considered as the fourth function (Amer et al., 2015).

In assessing the functionality of a biosphere reserve in the Afar region, reports of various studies reveal that the Afar region is endowed with rich and diverse natural and

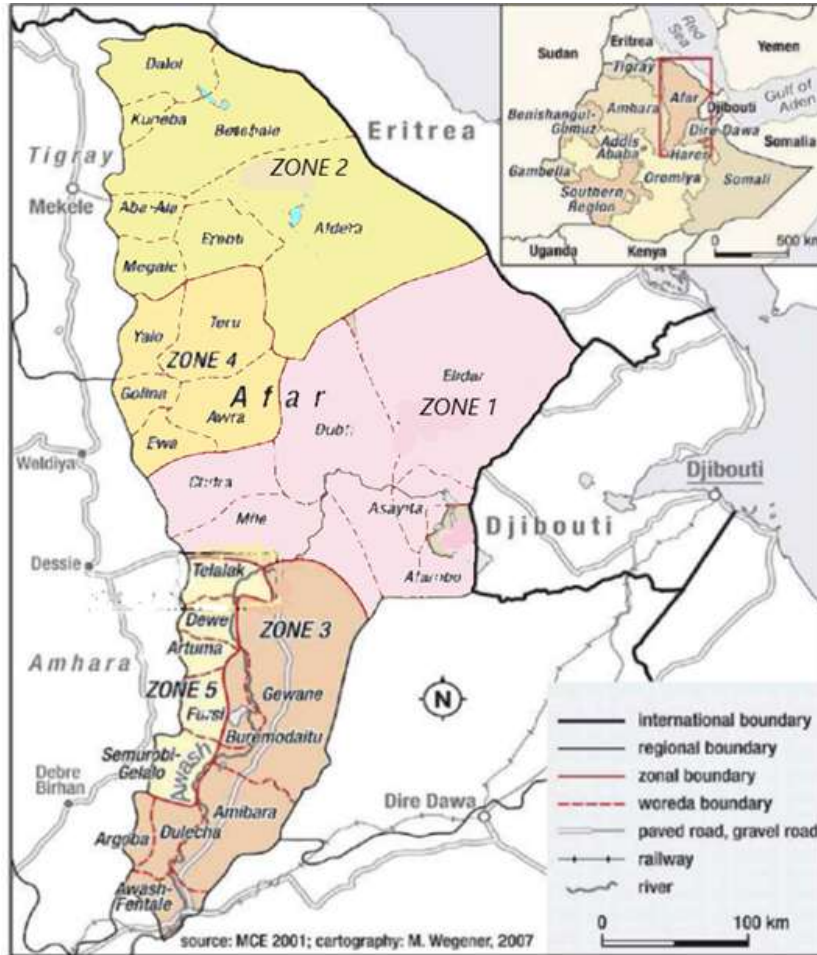


Figure 1. Administrative location of the Afar Regional State.
Source: Adopted from Biru et al. (2010).

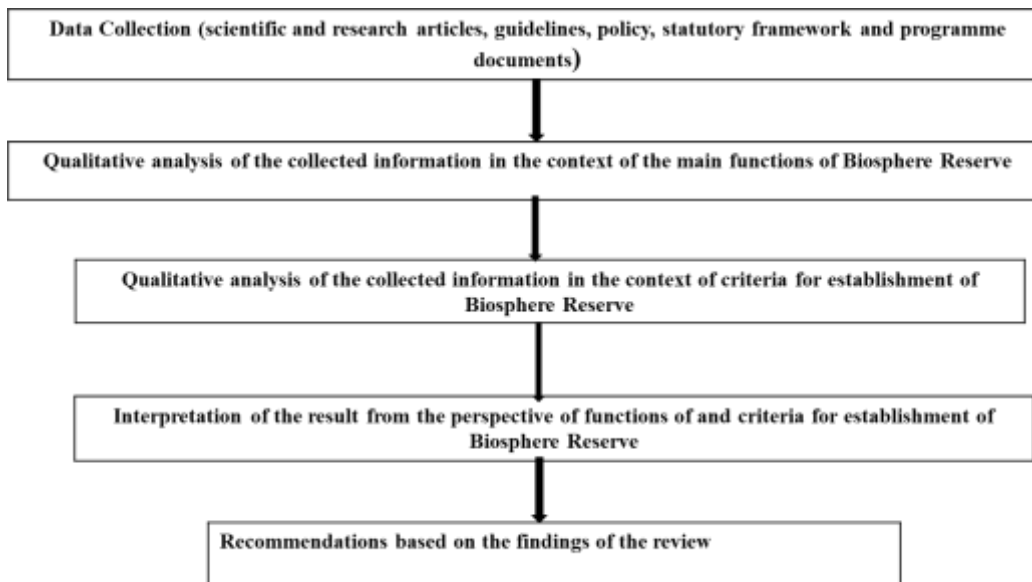


Figure 2. Scheme of research procedures.

cultural resources that have outstanding universal value from the perspective of conservation of biodiversity and culture, sustainable development and scientific research and monitoring (ANRS, 2000; Gebretensae, 2004; Tesfay and Tafere, 2004; BOPRD, 2008; Newsome and Dowling, 2010; ARCCH, 2016; Scott, 2019; Otálora et al., 2022). Generally, the conducive conditions for the three main functions of biosphere reserve from the perspective of the Afar region are presented and discussed subsequently.

One of the three purposes of biosphere reserves is the conservation of biodiversity. Without the ecosystems that support human lifestyles, communities, and economies, it is hard to exist. Like the case of African countries (IUCN, 1989), for the Afar people, biodiversity is not an abstract or theoretical issue; it is critical for their life at grass root level. The presence of biodiversity not only provides ecosystem resilience to cope with the periodic environmental stress in the region, but also delivers a living matter on which the society depends. In general, the Afar community of Ethiopia, natural resources are readily used as a matter of survival and conservation of biodiversity is closely linked to the cultural integrity of the community (Gebretensae, 2004; Tesfay and Tafere, 2004; Scott, 2019; Balehegn, 2020).

Moreover, representing the arid and semi-arid ecosystems of the country, the region is rich in biodiversity and it is a location for considerable number of endangered species that are of international conservation concern. The fact that about 9 conservation areas of different categories (namely: Yangudi-Rasa National Park, Awash National Park (partly), Halleydeghe, Gewane and Mille-Sordo Wildlife Reserves, Bilen-Hartele, Telallk-Dewe, Chifra and Dulecha Controlled Hunting Areas) have been set aside in the region (Hillman, 1993b, Gizaw and Gebretensae, 2019) not only indicates the wildlife potential of the area but also depicts the integration of the ecosystem in general and the diversity in each conservation area in particular. In addition to its significance as an important bird area (EWNHS, 1996; Birdlife International, 2022), the region is home to various wild species of mammals ranging from antelopes to equids and populations of carnivores and primates (Hillman, 1993a; Kingdon, 1997; Moehlman et al., 2013; Rubenstein et al., 2016; IUCN SSC Antelope Specialist Group, 2016, 2018; Gebretensae and Kebede, 2022; Gebretensae and Messele, 2022).

The Awash valley of the Afar region harbours so many remains of extinct and existing flora and fauna dating from roughly five million years ago to the present (Johanson and Coppens, 1976; Hill and Ward, 1988; Kimbel et al., 1994; ARCCH, 2016; Niespolo et al., 2021). Thus, the site is a location for unique and rare resources which are of outstanding universal value from the perspective of science, anthropology, paleontology and archaeology, and hence it is so imperative to devise sound conservation systems for the globally significant

resources.

Besides, the Afar society has unique historical and social settings linked to their intact cultural values and these values play significant role in the management of natural resources and hence ensure biodiversity conservation. Thus, the values embodied in the Afar community integrated culture have paramount importance in ensuring conservation of the ecosystem and bio-cultural diversity (ANRS, 2000; Gebretensae, 2004) and this is consistent with the national and international documents (UNESCO-MAB National Committee, 2011; UNESCO, 2013a, 2017 and 2021) which clearly state that one of the three main purposes of biosphere reserves is conservation of biological and cultural diversity.

With regard to sustainable development, there are considerable conducive situations on the ground to ensure sustainability of development activities and improvement of livelihood of local communities. As discussed subsequently, and also recognized by Tesfay and Tafere (2004), Balehegn et al. (2019) and Balehegn (2020), the contribution of the Afar traditional institution to sustainable development is considered as one of the best practices that has to be scaled up to other areas of the country and this is in line with the principles of biosphere reserve establishment which takes into consideration that Biosphere Reserves are learning places for sustainable development (Ruoss, 2013; UNESCO, 2021).

The Afars are semi-nomadic pastoralists, who depend on the rangelands to raise camels, cattle, sheep and goats. Most of the people of Afar region (90%) subsist on pastoralism focusing on activities related to seasonal variation in availability of feed and fodder for their livestock on which their livelihood depends. Their system of adaptation is highly responsive to seasonal variation in rainfall and range. Hence, they may move from one rangeland to another according to the season, in search of grass and water (ANRS, 2000; Gebretensae, 2004; Scott, 2019; Burka et al., 2023). These days, there is a transformation of life style to agropastoralism, which is also promoted by government and NGOs (BOPRD, 2008; Nanasa, 2021).

The region has a number of permanent rivers that embrace over eight perennial rivers that flow to different basins. All rivers are situated in the Awash basin and large and small-scale irrigated farms have been developed along this basin (ANRS, 2000; ARCCH, 2016; Nanasa, 2021). Thus, there is a need to integrate the emerging development activities with the existing traditional and contemporary conservation systems, including proper wetland management and restoration schemes (Nanasa, 2021).

The Afar region is endowed with cultural and natural resources that have local and global significance. These resources include the most important groupings of paleo-anthropological sites, extra-ordinary scenic landscapes, and unique and diverse wildlife (Johanson and Coppens,

1976; Alemseged et al., 2005; Haile-Selassie et al., 2012; ARCCH, 2016; Niespolo et al., 2021). Another emerging attraction which is also feasible in the context of Afar region is geo-tourism (Newsome and Dowling, 2010). Thus, these attractions combined with the fascinating and intact culture of Afar community are believed to create huge opportunity in developing sustainable tourism in the region and this adds significant value to the well-being of the people and hence boosts active participation of the local community as experienced in other countries of Africa (Amer et al., 2015; Pool-Stanvliet et al., 2018) as well as in the existing biosphere reserves of Ethiopia (UNESCO-MAB National Committee, 2011; Tadese et al., 2021; Choudhary et al., 2021). In addition to its natural beauty, the region has abundant potassium and salt mineral resources, located in areas that represent the historic salt trade in the Afar depression as well as the modern and ancient salt trail that passes through diverse regional ecozones (ARCCH, 2016; Woldekiros, 2019).

Considering the third function (logistic support) of biosphere reserve, the Afar region is generally part of the country that attracts the attention of intellectuals of all levels globally. It is a region that has played crucial role from the perspective of having scientific understanding in various fields. In the field of archaeology and paleontology, tremendous number of findings that have changed the knowledge and understanding of prehistory of humans were discovered and is still under discovery. In the Afar triangle, a lot of studies that have made a lot of impact in the research of human origins and evolution have been conducted and based on the findings of the studies, over 400 publications were made in internationally recognized scientific journals (Johanson and Coppens, 1976; Hill and Ward, 1988; Kimbel et al., 1994; Alemseged et al., 2005; Haile-Selassie et al., 2012; ARCCH, 2016; Niespolo et al., 2021). The research that has been undertaken in the middle-Awash basin for the last 40 years on both species of baboons (Hamadryas and Olive baboons) and their hybrid is considered as historic event in the field (Kummer and Kurt, 1963; Wrangham, 1980; Sigg et al., 1982; Anderson, 1983; Abegglen, 1984; Swedell, 2006). In general, the relatively intact and unique cultural set-up of the Afar community has attracted various researchers in the field of anthropology (Yaynshet and Kelemewerek, 2004; Gebre-Egziabher, 2014; Guesh and Debela, 2019).

With the mandate of undertaking technology generation, adaptation, multiplication and demonstration in lowland areas of the country under irrigation and marginal rainfall conditions, the Werer Agricultural Research Center has been conducting various research activities in the field of crops, livestock, natural resources, technology multiplication, socio- economics extension and agrometeorology for the past six decades (Workie et al., 2019). Moreover, the hydrology and Geology of the Awash basin have been studied by local and global researchers since 1970s (FAO, 1965; Gasse et al., 1978;

Ketema et al., 2016; Mitiku et al., 2022). Since the recent past, the number and proximity of high-level academic institutions and research centres is increasing and thus there are conducive conditions towards exploring scientific ways and undertaking monitoring towards sustainable development.

The facts discussed earlier show that there are favorable conditions to explore and demonstrate approaches to conservation and sustainable development as well as research and monitoring and thus areas in the region fulfill the aforementioned main functions of biosphere reserve and this is consistent with Article 3 of the Statutory Framework of the WNBR (UNESCO, 2013a, 2017, 2021; Amer et al., 2015).

Criteria for designation as biosphere reserve

Generally, the natural and cultural properties as well as ecological aspects of the Afar region that have paramount importance in the context of designation of biosphere reserve are presented and discussed in the following.

Representativeness of the ecological systems for major bio-geographic regions

The study area represents the vast area of the northern part of the Great Rift Valley in Ethiopia and starts at the point where the valley widens out into the Afar depression. Geologically, the recent episode of sea floors spreading has created the Afar crust with a multiplicity of extensional faults which has split apart the Danakil and Aisha horsts, and has witnessed the faulting of the main Ethiopian rift and Afar margins. Generally, geomorphology of the Afar region includes escarpments, basement of escarpments and the plain areas (Gibson, 1967; Ilesley-Kemp, 2018; Niespolo et al., 2021).

The Afar region, which is characterized by volcanic activities, consists of different types of landforms. These forms include volcanic cones, lakes, rivers, hot springs and calderas with active vents. The creation of volcanic cones and calderas, along with several eruptions has contributed to the superlative natural phenomena and general appearance of the areas surrounding them. For example, evaporates that covered the Danakil depression have different coloration depending on the type of mineral erupted during the passive volcanic activities (Cavalazzi et al., 2019; Otálora et al., 2022). One of the hottest places on earth, the Dallol depression boasts a distinctive natural setting and geological characteristics, such as depression 120 m below sea level. The Ertale volcano, which has one of the few active lava lakes in the world, the salt lakes, hot springs, hill Dallol, and its salty gorges are some of the other attractions (ARCCH, 2016; Woldekiros, 2019).

Temperatures vary from 25°C in higher elevations to 48°C in lower elevations. Rainfall is bi-modal throughout the region with a mean annual rainfall below 500 mm in the semi-arid western escarpments and decreasing to 150 mm in the arid zones to the east (Biza, 2014; Fenta et al., 2019). The Afar region is a location for the hottest place on Earth, the Dallol. Based on year-round averages (for one year), Dallol's average is the highest (Schrader, 2019).

The hydrological status of Afar region is mainly influenced by surface water resources, which include rivers, springs, ponds and lakes. It has a number of permanent rivers that embrace Awash, Mille, Kesem-Kebena, Awura, Gulina, Dewie, Borkena, Telalak, as well as numerous temporary rivers that flow to different basins. Furthermore, the area also has a number of lakes, such as Lake Asale, Lake Afdera, Lake Abe, and Lake Gemeria. Mille and Logia Rivers traverse the region are the tributaries of the Awash River (ANRS, 2000; ARCCH, 2016). The Awash River is the second longest river in the country (about 1200 km) and it ends in the heart of the Afar depression in Lake Abe at an elevation of 250 m asl, from which there is no surface outlet (Halcrow, 1989; ANRS, 2000; Gebretensae, 2004).

According to FAO (1965), the soil types in the study area are generally grouped into three: Ancient alluvial and collegial, recent alluvial and volcanic material soils. These soil types were classified based on the parent material from which they were derived. In general, the vegetation types of the area range from grassland, open grassland, shrubland, woodland, wooded grassland at the lower altitudes to thicket riverine forest around the wetlands (FAO, 1965; Friis et al., 2010; Meuer and Moreaux, 2017). The grassland areas are dominated by *Chrysopogon plumulosus*, *Bothriochia radicans*, *Hypharrena hirta* and *Themeda triandra*. The woodlands are mainly characterized by Acacia species (*Acacia tortilis*, *Acacia oerfata*, *Acacia senegal*, *Acacia melifera*, *Acacia nilotica*, etc.), *Grewia* species (*Grewia bicolor*, *Grewia tenax*, *Grewia villosa*, and *Grewia erythraea*), *Commiphora* species and *Ficus* species. In some instances, *Balanites aegyptiaca* and the *Dobera glabra* replace the *Acacia* cover.

The aforementioned habitats are renowned for their varied ungulate populations including Beisa oryx (*Oryx beisa*), Soemmerring's gazelle (*Nanger soemmerringi*) and the Dorcas gazelle (*Gazella Dorcas*), Salt's dikdik (*Madaqua salitiana*), Greater kudu (*Tragelaphus strepsiceros*), Lesser kudu (*Tragelaphus imberbis*), Defassa waterbuck (*Kobus ellipsiprymnus defasssa*) and Common bushbuck (*Tragelaphus scriptus*) (Gebretensae, 2004; Meuer and Moreaux, 2017; IUCN SSC Antelope Specialist Group, 2016 and 2018). The existence of larger carnivores such as Lion (*Panthera leo*), Leopard (*Panthera pardus*), Spotted hyena (*Crocuta crocuta*), Striped hyena (*Hyaena hyaena*) and various species of jackals in the area. (Gebretensae and Kebede, 2022; Gebretensae and Messele, 2022) indicates that there is a

relatively healthy prey-predator relationship. Moreover, the distribution of the threatened antelopes such as Soemmerring's gazelle and the Dorcas gazelle in Ethiopia is restricted to the Afar region. Besides, the region is represented by three broad important bird areas (EWNHS, 1996; Birdlife International, 2022).

The points explained earlier clearly show that the Afar region, which is not represented by the existing Biosphere Reserves of the country, is a location for the hottest place on earth and plays substantial and irreplaceable role in maintaining the arid and semi-arid part of the country. Thus, the region has significance representation in the ecological system of Ethiopia and establishment of biosphere reserve in the Afar region fulfills the criteria indicated under article 4 (1) of the Statutory Framework of the World Network for Biosphere Reserve (WNBR) (UNESCO, 2013a, 2013b, 2021).

Significance for conservation of biodiversity and intact culture

As explained earlier, the important event that explains the great natural beauty of the Afar region is its role as an integral component in the arid and semi-arid ecosystem representing the lowest altitude of the Great Rift Valley. The region is a location for hundreds of species of wild mammals and birds and network of protected areas of different categories have been established (even though most of them remain on paper only) in the region to conserve the existing wildlife potential. The area is not only the lone stronghold habitat in harbouring the highest population of the vulnerable Gazelles (*N. soemmerringii*) and *G. dorcas*) and the endangered Beisa oryx (*O. beisa beisa*), which has become extinct in other parts of Africa including Uganda (Kingdon, 1997), but also it is the only place of safety for the critically endangered and endangered equids: the African wild ass (*Equus africanus*) and the Grevy's zebra (*Equus grevyi*) (Moehlman et al., 2013; Rubenstein et al., 2016).

Since the recent past, Beisa Oryx (*O. beisa beisa*) has been considered to be endangered species under criteria A2ad and C1 of IUCN red listing (IUCN SSC Antelope Specialist Group, 2018). The status of these highly threatened species of wild animals has become in recent years the focus of global conservation efforts.

Furthermore, the region is home to the pastoralists who have been living together in harmony and in tolerance with their environment as the Afars are trans-humant pastoralists who depend on rangelands to raise camels, cattle, sheep and goats (Gebretensae, 2004; Scott, 2019). They are situated in the arid and semi-arid environment of which some areas are harsh to life. Therefore, the Afar people have accumulated a lot of indigenous knowledge of their ecology and their natural environment and the knowledge which has been transmitted from one generation to the next is tied to their cultural value (Tesfay and Tafere, 2004; Balehegn et al.,

2019; Scott, 2019). For example, the Afar pastoralists are adapted to their environment through practicing various traditional mechanisms, which help strengthen their cultural integrity and they make use the arid areas where climatic variability is large and their living system has relatively been preserved intact for a long period of time (ANRS, 2000; Balehegn, 2020). Generally, the pastoralist communities have been practicing traditional mechanisms for centuries in order to manage and sustainably utilize the resources in the ecosystem (ANRS, 2000; ARCCH, 2016). Therefore, the afore-mentioned biodiversity and cultural values, combined with its location for renowned archaeological and paleontological sites (WoldeGabriel et al., 2000; Alemseged et al., 2006; ARCCH, 2016; Niespolo et al., 2021) make the region a significant Biosphere Reserve where humans, culture and biodiversity are evident. In other words, there is ample reason to designate many areas of the region as a Biosphere Reserve under UNESCO's man and biosphere programme and in accordance with article 4 (2) of the Statutory Framework of the WNBR (UNESCO, 2013a, 2013b, 2021).

Opportunities to explore and demonstrate approaches to sustainable development

The Afars have strong and cohesive social institutions and their social organization is more influential than the religion in the social, cultural and economic activities of the Afar people (ANRS, 2000; Gebtensae, 2004). They have three traditional institutions that deal with their daily livelihood (Tefay and Tafere, 2004; Scott, 2019; Balehegn et al., 2019). These institutions include: (1) the Edo or range scouting where traditional rangeland scouts are sent on a mission to assess environmental conditions, including weather, range and associated resources; (2) the Dagu, a traditional secured and reputable network, through which the necessary information is shared among users; and (3) the Adda or the traditional Afar governance system, which analyses the existing situation based on the information in hand before community decisions are made. Utilizations of natural resources such as trees, water and rangelands have rules. These rules are implemented according to the regulations set by the Afar traditional authority vested upon elders and customary laws (ANRS, 2000; Tefay and Tafere, 2004; Scott, 2019; Guesh and Debela, 2019). Thus, it is believed that the integration of the norms, practices and traditional organizations with the contemporary approaches provides the opportunities to enhance economic development that is socio-culturally and environmentally sustainable as indicated in previous studies (Gebre-Egziabher, 2014; Engdasew, 2022).

Thus, the Afar traditional institution's contribution to sustainable development is in line with the guiding principles for the establishment of biosphere reserves,

which recognizes that biosphere reserves serve as learning environments for sustainable development (Ruoss, 2013; UNESCO, 2017 and 2021) and this can be regarded as one of the best practices that need to be expanded to other regions of the nation (Balehegn, 2020). Furthermore, community cultural development initiatives which include various programs and action that aim at promoting both tangible and intangible cultural heritages and customary practices can be realized in the process of establishing and implementing the functions of biosphere reserve and this in turn can enhance active participation of the local community and other stakeholders and fostering network of cooperation at all levels (UNESCO, 2013b).

One of the traditional institutions in the Afar community is exclusively constituted by young men (Tefay and Tafere, 2004; Balehegn et al., 2019; Scott, 2019; Balehegn, 2020), and this appears to create a conducive condition to the sustainability of the social and economic development of the region since participation of the youth and women is a vital component in the establishment of Biosphere Reserve and implementation its of functions (UNESCO, 2013a, b). According to Tefay and Tafere (2004), Scott (2019) and Balehegn et al. (2019), the Dagu system, is a traditional secured and reputable network, through which the necessary information on Afar community's livelihood and associated development activities is shared. Thus, this system is considered as an opportunity to ease the communication in solving the obstacles that may encounter in the management of biosphere reserves in general and in designing associated development projects in particular (UNESCO, 2021).

Afars, through their traditional institutions, practice dispute resolution mechanisms (Tefay and Tafere, 2004; Gebre-Egziabher, 2014; Guesh and Debela, 2019) and usually make the safest decisions that are socially and environmentally feasible from the perspective of social and environmental sustainability. For the Afar community, who live in a relatively harsh environment, the issue of climate change and biodiversity conservation is a critical one. The Afar pastoralists traditionally predict weather and climate variation through the observation of diverse bio-physical entities including livestock, insects, birds, trees and wildlife (Scott, 2019; Balehegn et al., 2019).

Generally, even though the Afar community is relatively vulnerable to climate change, there are community responses and best practices that can be scaled up to enhance resilience to climate change and some of them can also be adopted from other pastoral areas outside of Afar. These best practices would be useful in agriculture, water, rangeland, energy, health sector, education, institutional capacity building, infrastructure, management of natural resources and flood protection (ANRS, 2000; Fenta et al., 2019).

In the context of tourism development, the cultural and natural resources of the Afar have local and global

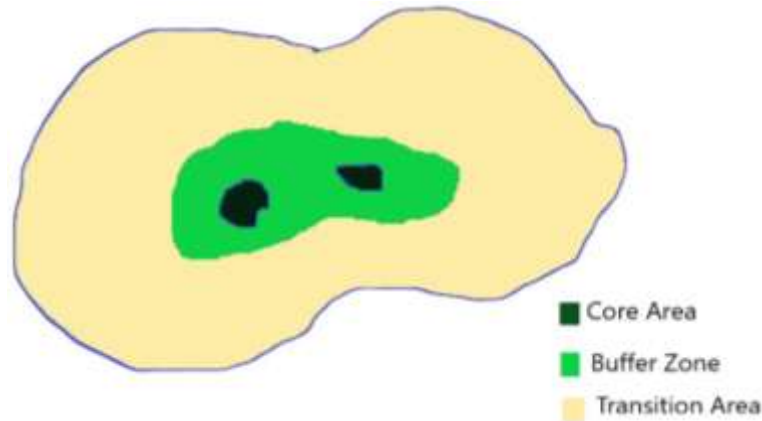


Figure 3. Biosphere reserve zonation.

significance. The Afar region is one of the locations for the most important groupings of paleo-anthropological sites on the world. It is also a location for extra-ordinary scenic landscapes such as Dallol, Erta Ale, Afdera Lake, and Alalo Baad Fel. As explained earlier, the region also harbours unique and diverse wildlife (ANRS, 2000). Another emerging attraction which is also feasible in the context of Afar region is Geo-tourism, a form of natural area tourism that specifically focuses on landscape and geology (Newsome and Dowling, 2010). Therefore, these attractions combined with the fascinating and intact culture of Afars, are believed to create huge opportunity in developing sustainable tourism taking into account the existing comparative advantages of the region and also taking into consideration the best practices from south western Ethiopia (Choudhary et al., 2021) and other countries of Africa (Charnley, 2005) in this regard.

In general, the details discussed earlier depict that establishment of the biosphere reserve in the region provides ample opportunities to explore and demonstrate approaches to sustainable development, through which balance between nature conservation and socio-economic development is created by engaging the local communities and using a knowledge-based approach (Ruoss, 2013; Amer et al., 2015; UNESCO, 2021).

Existence of appropriate size and options for zonation and addressing the functions of biosphere reserve

As indicated earlier, the Afar region comprises diverse landscapes as well as cultural and natural resources. It is also understood that there are favourable conditions to contribute to the conservation of landscapes, ecosystems, species and genetic resources. There are also opportunities to encourage economic and human developments which are socially, culturally, and environmentally sustainable and these aspects are in coherent with the main global goals of sustainable

development (UNESCO, 2013a; Ruoss, 2013; United Nations, 2022). There are also considerable efforts in using research, monitoring, education and information exchange to build the capacity of the community and make informed decision.

In order to undertake the complementary activities of biodiversity conservation and sustainable use of natural resources, the three interrelated zones, known as the core area, the buffer zone, and a transition area (Figure 3) are important components in the establishment and management of biosphere reserves (UNESCO, 2013a, b, 2021).

In the case of Afar region, there is conducive environment to designate the three zones. The zonation of the biosphere reserves to be designated, will be selected based on existing and planned land uses, contemporary and traditional ecological knowledge as well as scientific research works. Designation of the three zones in the region with significant size can be undertaken taking into consideration the following different options.

Establishment of a biosphere reserves without considering the previously designated protected areas as core zone:

As explained earlier, the region is endowed with relatively intact natural habitats that include open grasslands, rivers, riverine forests, lakes and associated wetlands of which the majority are found outside of protected areas and these natural habitats harbour considerable number of threatened species of wild animals that include Wild ass (*E. africanus*), Beisa oryx (*O. beissa*), Summering's Gazelle (*N. soemmerringi*), Dorcas gazelle (*G. dorcas*) and large carnivores, including African lion (*Panthera leo*) and Cheetah (*Acinonyx jubatus*). Therefore, this option gives the opportunity to protect the threatened species in the core area while practicing cooperative activities such as environmental education, research, recreation and ecotourism in the buffer zone and the transition area will include sites where ranges, settlements and other land

use activities are managed and developed in a sustainable way for which different stakeholders and local communities cooperate in accordance with the Statutory Framework of the WNBR (UNESCO, 1996).

Establishment of a biosphere reserves by considering the previously designated but lacking active management protected areas as core zone: In the Afar region, there are 9 conservation areas of different categories (Gizaw and Gebretensae, 2019), of which only two National Parks (Awash and Yangudi-Rasa) and one proposed National Park (part of the Halleydeghe Wildlife Reserve) have active management. The four Controlled Hunting Areas (Bilen-Hartele, Telalak-Dewe, Chifra and Dulecha) are mainly ran by concessionaires based on a contract agreement (EWCA, 2020) and thus there is no regular active management practice. The remainders (Wildlife Reserves) have no management, but exist on paper only (Jacobs and Schloeder, 2001). Thus, this gives the preference to consider the protected areas (PAs) without active management as core area while setting aside the areas around PAs as buffer zone and transition area.

Establishment of biosphere reserves by considering the previously designated and possessing active management protected areas as core zone: This option gives the opportunity to consider the protected areas (PAs) with active management indicated earlier as core area while setting aside the areas around PAs as buffer zone and transition area.

Establishment of international transboundary biosphere reserves: This option gives the opportunity to designate a trans-boundary biosphere reserve along the border with Djibouti by setting aside Lake Abbe (one of the important birds Areas) and its surroundings as core area and creating buffer and development zones around it. It is also possible to take into consideration the common habitats of African wild ass both in Ethiopia and Eritrea as core area. This approach is expected to boost bilateral cooperation between the bordering countries (Moreaux et al., 2017).

Establishment of biosphere reserves taking into consideration mixed important resources that require long-term protection: This option deals with consideration of areas which are locations for paleo-archaeological sites and at same time inhabited by the threatened species of wildlife as core areas.

CONCLUSION AND RECOMMENDATIONS

The Afar region is endowed with rich and diverse natural and cultural resources that have outstanding universal value from the perspective of conservation of biodiversity

and culture, sustainable development and scientific research and monitoring. In general, the details discussed earlier reveal that the region plays substantial and irreplaceable role in maintaining the arid and semi-arid part of the country and in conservation of biodiversity and outstanding cultural values. Furthermore, establishment of the Biosphere Reserve in the region provides ample opportunities to explore and demonstrate approaches to sustainable development and to make use all three zonation schemes. Thus, the region has significant areas that well fulfill the basic functions and criteria for designation of Biosphere Reserve. However, the fact that there is no such conservation area system in the region indicates that the potential areas in the Afar areas are fully neglected. It is therefore recommended to address this gap and establish biosphere reserves in the region, following the basic principles and criteria for designation of such schemes of conservation areas and considering the possible options indicated earlier.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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