Land-use planning for community-based ecotourism potentials in the central highlands of Ethiopia

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Abstract

The aim of this study was to suggest suitable sites for community-based ecotourism (CBET) experiences and integrated management zone planning based on the potential of the site at the social-ecological Lake Wanchi watershed (LWW) and its adjacent landscapes. Comprehensive survey was made to obtain both the theoretical and conceptual insights before instigating the actual data collection. Data were collected using GIS and remote sensing supplemented with various biophysical and socio-economic field data, such as key informants interview, ground control points, and document analysis. The GIS-based multiple criteria decision analysis and the analytical hierarchy process were used for the identification of potential CBET sites, where visibility, vegetation-cover, elevation and slope were used as indicators for potential ecotourism attractions. Quantitative data captured through GIS and remote sensing application was analyzed using ArcGIS 10.3, while the non-quantifiable data were analyzed using context analysis and qualitative descriptions. Site suitability analysis resulted with four potential degrees of suitability classes: highly suitable, moderately suitable, marginally suitable and less suitable for ecotourism. Four potential eco-lodges and nine eco-camp sites were also identified. Subsequently, CBET potential suitability map for ecotourism experiences was generated, based on the linear combination of the criteria and indicators with their respective weights. Five key management zones, namely, protected zone (11.5%), multiple use zones (33%), sustainable use zone (13%), specific use zone (35.75%), and rehabilitation zone (6.7%) were identified. To maintain the sustainability of the local environment and the living conditions of residents any ecotourism enterprise must be planned based on the potential of the site.

1. Introduction

The land-use planning (LUP) process, strategies, and activities for ecotourism potentials depend on the destination and its characteristics including the geographic, economic, socio-cultural context (FAO, 2020), and ecotourism development stages among other factors (Tasci, Semrad and Yilmaz, 2013; FAO, 2020). It is known that not all areas have equal potentials to realize sustainable ecotourism development. For instance, some areas might have greater attraction potential for satisfying the benefits of ecotourism than others. Whatever the case may be, the LUP process is critical to realize ecotourism's potential as a powerful tool for biodiversity conservation, livelihood improvement (Drumm and Moore, 2005), and delivering an experience that meets visitor expectations (WWF, 2001). These three distinct, but closely interrelated and functionally interdependent aspects of ecotourism, *conservation management, economic development and visitor satisfaction*, must fully understood by land-use planners before moving ahead with plans to implement any ecotourism activities. There should also be a clear understanding of the relationship between local communities and environmental conservation and how this might be improved through their involvement for planning and implementing sustainable ecotourism development (WWF, 2001).

Ecotourism is a form of multidimensional economic activity that contributes actively to the local development through the conservation of natural and cultural resources. Under the right circumstances,

ecotourism can have less impact than other economic alternatives, such as expanding agriculture, unsustainable utilization of forests, consumptive use of wild animals, and other similar activities (Kiss, 2004; Li, 2004); it can serve as a means of reducing local threats to biodiversity (Lapeyre, 2010). The principle is that if communities perceive a benefit from conserving of natural resources, their livelihood sustenance will no longer depend on the exploitation of these natural resources (Goodwin, 2002; Rechlin *et al.*, 2008). Conversely, the explosive trend of ecotourism and its promises of rapid development may create a maximum challenge to the resources of a country or region, and bring undesirable side effects that can threaten the very resources it depends on (WWF, 2001; Lapeyre, 2010; Angessa, Lemma, Yeshitela, and Endrias, 2022). Besides, poorly planned and managed eco/tourism growth has led to irreversible degradation of the biodiversity resources; destroyed ecological functions; raise the cost of living; and damage socio-cultural traditions and lifestyles of the local community (Mann, 2006; UNECA, 2011). Similarly, there are reported incidents where forms of ecotourism, which were not sufficiently community focused had a negative impacts on the environment and the livelihoods of the local community, where the case in Brazil was the best occasions (WWF, 2001). To maintain the sustainability of the local environment and the living conditions of residents, any ecotourism planning and implementation should build from the knowledge of community values and organizational needs to guide more locally-appropriate ecotourism development that fits with other community needs, initiatives, and opportunities. In line with this, community-based ecotourism (CBET) might play a sensible role in ecological security, resource sustainability and community development that can bring people into conservation (Ngece, 2002).

Community-based ecotourism is a special form of ecotourism that involves local and indigenous communities in its planning, implementation, monitoring and evaluation, and decision making process that contributes to the well-being of the society (Tasci et al., 2013). In principle it aims to achieve the *triple–win* situations, that is, to facilitate community development and empowerment, enhance visitors' experiences, and maintains long term conservation of the natural and cultural resources through community control and participation. Under suitable conditions, CBET helps to conserve biodiversity, alleviate poverty and benefit groups of stakeholders such as indigenous and/or traditional communities as well as disadvantaged and marginalized groups living in and around ecotourism destinations. The attraction of CBET is the prospect of linking biodiversity conservation and local livelihoods, whilst simultaneously reducing rural poverty and satisfying the needs of eco-tourists (Kiss, 2004).

Corresponding to eco/tourism when the underlining premises are disregarded, CBET practices can also incur negative environmental impacts to the ecotourism destinations, and cause economic and socio-cultural costs on the local community (Tasci et al., 2013). However, appropriately planned CBET can lead to the management of all resources in such a way that economic, social and aesthetic needs can fulfilled while maintaining cultural integrity, essential ecological processes, and biological diversity and life support systems (WWF, 2001). More than advocacy, nowadays CBET is viewed as an enterprise that, if properly planned, implemented and developed, will benefit not only local communities, but most importantly, the very local resources that local residents heavily depend on (Angessa, 2020). The planning and promotion of such environmentally sound, economically feasible, and socio-culturally acceptable

ecotourism, especially in areas of significant natural endowments like that of the Lake Wanchi watershed (LWW) and its adjacent landscapes, offers many opportunities in biodiversity conservation while realizing sustainable local development strategies.

The unique natural and cultural landscapes, historical features, and rich flora and fauna make the LWW and its adjacent landscapes among the most popular ecotourism destinations in Ethiopia (Ogato, Abdise, Gammie, and Abebe, 2014; Teressa, 2015a; Angessa et al., 2022). Owing to the topographic attractiveness of the landscape, most tourists call Lake Wanchi and its adjacent landscape as *"The Switzerland of Africa"*, while others call it as "*the hidden garden of Eden*" (Angessa, 2020). As a result, Wanchi Ecotourism Association (WETA) was established in 2002 with the major aim of fostering the conservation of natural resources while supporting the livelihoods of local communities. It also aimed to develop and introduce a consolidated ecotourism management approaches that serves as a model for other areas elsewhere in the country having similar topography and social-ecological settings.

Despite its social-ecological importance for ecotourism development, LWW and its adjacent landscapes presently faced with severe environmental degradations leading to the loss of biodiversity and ecosystem services on which local livelihoods depend (Angessa et al., 2020; Angessa, Lemma, and Yeshitela, 2021). For instance, land-use and land-cover change study from 1973–2017 indicated that about 62% of the original landscape found in the watershed experienced land-use and land-cover conversions in one way or the other (Angessa et al., 2021). To this end, Pinel (1998), stated that CBET planning approach can be particularly relevant for areas facing difficult conversion from deteriorating or collapsed resource-based economies. On the other hand, most ecotourism developments in Ethiopia, including WETA are characterized by lack of environmental standards and haphazard planning (Angessa et al., 2022). Other studies also indicated that the lack of LUP based on the potential of the site as one of the critical natural resource management problems (Angessa, 2020); and absence of appropriate legal and regulatory frameworks for sustainable ecotourism development (Ogato et al., 2014; Teressa, 2015a) in the LWW and its adjacent landscapes. As a result it has been difficult to manage natural resources, monitor environmental changes and design sustainable environmental management strategies (Angessa et al., 2021). In addition, Teressa (2015a) stated that the area lacks land-use zoning, which could be evidenced by the absence of well-designed trekking pass, parking facilities, camping sites, walking roads along the lake, boarding, eco-lodge and other catering facilities down the lake. These, in turn, have hindered the contribution of the ecotourism initiatives for biodiversity conservation, landscape restoration, and socio-economic development of the local communities and the country at large (Angessa et al., 2022). Consequently, appropriate LUP and management was recommended to the LWW and its adjacent landscapes to optimize the positive economic, environmental, and socio-cultural impacts of ecotourism development on the livelihood of local communities (Ogato et al., 2014; Teressa, 2015a; Angessa et al., 2021). Therefore, LUP based on the potential of the site at the LWW and its adjacent landscapes can provide direct benefits that can offset pressure from other less sustainable activities that make use of natural and cultural resources and reduces the undergoing environmental degradations and socio-cultural deteriorations (see also Angessa et al., 2022).

To determine the most desirable future land-use patterns, the potential or suitability of a particular site or region for various development activities should be carefully studied (Bunruamkaew & Murayama, 2012). Currently, Geographic Information System (GIS) and remote sensing technologies supplemented with different biophysical and socio-economic data are commonly used as an integral part of spatial planning and multiple objective decision-making including identifying potential sites for ecotourism development (Bunruamkaew and Murayama, 2011; 2012; Šiljeg et al., 2019; Sahani, 2019). There are different multiple criteria determinations and various factor classifications needed for identifying and prioritizing potential ecotourism sites. Several scholars used different criteria and indicators for identifying potential ecotourism sites and prioritizing for the sustainability of ecotourism developments. Kumari et al. (2010) applied five index-based indicators such as ecological value, ecotourism attractiveness, environmental resiliency, ecotourism diversity and wildlife for the identification of potential ecotourism sites. Ghamgosar (2011) used six physical elements as indicators such as slope, aspect, elevation, soil, rock and land-use for the identification of potential tourism sites. Bunruamkaew and Murayama (2012) applied five criteria (with nine indicators in the form of GIS-based thematic layers) such as landscape/naturalness, wildlife, topography, accessibility and community characteristics for the identification of suitable site for ecotourism development. Gourabi and Rad (2013) applied eight thematic layers such as sunny days, temperature, relative humidity, slope, direction, soil texture, water resources and vegetation density. Ullah & Hafiz (2014) applied five criteria (consisting of 15 indicators) such as landscape, wildlife, topography, cultural heritage, and community characteristics to identify suitable sites for ecotourism development. Asmamaw and Gidey (2018) used five criteria (consisting of seven indicators) to assess potential ecotourism sites including environment, pedology, topography, recreational attractiveness, and climate. Šiljeg et al. (2019) used four criteria (consisting of ten indicators) including landscape, topography, hydrology and community as indicators of potential ecotourism sites. From these variations in the usage of the criteria and indicators/thematic layers, it can be noted that the selection of criteria and indicators mainly depends on the basic characteristics of the ecotourism destination under consideration, the availability of potential ecotourism attraction resources in that locality, expert knowledge (judgment) and other similar factors. However, landscape/naturalness and topography are the most frequently used criteria appeared in almost all surveyed literatures used GIS-based multiple criteria objectives for identification of potential ecotourism sites. Hence, in this study two criteria and four indicators, namely, landscape/naturalness (consisting of visibility and vegetation-cover) and topography (consisting of slope and elevation) was determined based on the characteristics of the study landscape, and combination of various other factors.

Sustainable LUP and management based on the potential of the site for ecotourism development, particularly in environmentally sensitive and ecologically fragile ecosystem is indispensable to maximize the positive impacts and minimize the negative impacts of ecotourism destinations (Angessa et al., 2022). Zoning is another useful management tool in environmental planning that is of a particular importance in defining the optimum use of an area based on its potentials (Ohadi et al., 2013). As part of the process of sustainable area management, zoning is likely to relate specifically to the types of activities that are permitted in particular zones, as well as delineating those activities that are not

permitted (Mason, 2013). It is one of the most important issues facing most protected areas and ecotourism destinations and is usually the best way to reconcile an array of different issues and uses of an area (Kelleher, 1999). The concept of integrated management zone planning can perhaps best be understood by considering the different approaches to reconciling human demands of sustainable development including environmental conservation, economic development, socio-cultural integration and community empowerment through ecotourism development that have evolved over the past century.

With this background information, this paper aims to identify suitable areas for different CBET experiences, and suggest sustainable LUP based on the potential of the site in the social-ecological LWW and its adjacent landscapes using GIS and remote sensing applications supplemented with biophysical and socio-economic field data. More specifically, it was to: (1) identify potential ecotourism attraction sites in the study landscape using multiple criteria decision analysis; (2) producing land-use suitability maps for future CBET development activities and (3) suggest integrated land-use management zones based on the potentials of the sites for effective application and implementation of sustainable CBET development.

2. Study Area And Methods

2.1 Study area

The study was conducted in the social-ecological LWW and its adjacent landscapes located in Wanchi district, Southwest Shoa Zone, Oromia, central highlands Ethiopia. Lake Wanchi is a Crater Lake formed as a result of volcanic eruption located at about 155 km to the southwest of Addis Ababa (8° 45’ – 8° 49’ N and 37° 50’ – 37° 55’ E). Lake Wanchi watershed is found in the Hero Wanchi rural Kebele (the lowest administrative unit) and is bordered by 12 other adjacent Kebeles (Fig. 1). The lake provides an attractive landscape scenery, nature and culture with its ability of ecosystem in accepting managed level of visitors, and cultural landscapes being shaped (Teressa, 2015a; Angessa, 2020). The lake has a surface area of about 560 hectares. According to Degefu, Herzig, Jirsa, & Schagerl (2014), the lake has mean and maximum depths of 28 m and 107 m, respectively.

The LWW is a highland watershed characterized by mountain hills, steep slopes, gorges, and valleys. The altitude ranges from 2810–3385 m above sea level. According to Angessa (2020) the average annual temperature is 17.8^{o}C with a maximum of 23.4^{o}C and a minimum of 12.2^{o}C, whereas the mean annual rainfall is 1402 mm. Unimodal type of rainfall with longer rainy periods extending from June to September characterizes the study watershed with peck rainfall in July and August. Based on the international slope classifications standards of WOCAT (2007), the slope of the area ranges from flat (0–3%) at the lake water surface to very steeply sloped terrain (> 60%) near the ridges.

Lake Wanchi watershed and its adjacent landscapes are among the most magnificent ecotourism destinations in Ethiopia, featuring spectacular natural landscapes (mountains, valleys, waterfalls and Lake Wanchi itself with its islands and peninsulas). The natural vegetation; mineral waters and hot

springs; ancient churches and monasteries; and the eye-catching huts with *Enset* (*Ensete ventricosum*) dominated home gardens make the LWW and its adjacent landscapes one of the most ecotourism potential destinations (Angessa et al., 2022). The landscape is an ideal site for such ecotourism activities: mountain hiking/trekking, boating, horse riding, forest exploring and camping, adventure, bathing in holy waters, bird watching, cable-car transportations and many other ecotourism oriented leisure activities (Teressa, 2015a; Angessa, 2020).

Sub-afro-alpine vegetation dominated by *Erica* species is the characteristic vegetation type of the study watershed. However, there are also indigenous plant species such as *Hagenia abyssinica,Hypericum revolutum, Protea gaguedi, Rosa abyssinica, Lobelia giberroa, Solanecio gigas, Rumex nervosus and Rubus* species that have tourism importance, especially during their flowering seasons (Angessa, 2020). However, the natural vegetation in the LWW and its adjacent landscapes has extensively cleared to give way for additional agricultural activities (particularly at the steep slope areas), establishment of human settlements and over extraction of wood for construction materials and fuel-wood purposes (Angessa et al., 2020). *Colobus guereza*, *Tragelaphus sylvaticus, Sylvicapra grimmia, Anubis baboon*, Common jackal, and Common hyena are the commonly observed wild mammals. Even though study on the bird species in the area is scanty, *Gyps africanus, Milvus aegyptius, Tauraco leucotis*, and the endemic bird to the Ethiopian highlands Wattled ibis *(Bostrychia carunculata)* are some of the bird species that are common to the area (Teressa, 2015b).

2.2 Study methods

2.2.1 Sampling strategies

In any community-based development projects, an initial feasibility assessment should be the primary option to be considered. Indeed, for this study, a comprehensive reconnaissance survey, detail analysis of the past and present conditions of the study watershed and the existing literature survey was made to obtain both the theoretical and conceptual insights before instigating the actual data collection. Both primary and secondary data were used for this study. Primarily data were collected using GIS and remote sensing applications; key informants interview (KII), and field observations. Purposive sampling was used to select the key informants. Representatives of governmental and non-governmental organization officers, experts, WETA members, tour-guides, and local knowledgeable individuals were used as key informants. Secondary data were collected through document analysis of the pertinent institutions.

2.2.2 Data collection techniques and tools

The GIS-based multiple criteria decision analysis (MCDA) with the analytical hierarchy process (AHP) was used for the identification of potential ecotourism sites at the LWW and its adjacent landscapes (see also Kumari et al. 2010; Bunruamkaew and Murayama, 2011; 2012; Šiljeg et al., 2019; Sahani, 2019). The fundamental problem of decision analysis concept is how to derive the relative weights of the criteria and indicators (Bunruamkaew and Murayama, 2011; 2012). Among the various MCDA techniques AHP is a well-known and commonly used in determining weights of the thematic layers for decision making

processes (Bunruamkaew & Murayama, 2011; 2012; Sahani, 2019). An AHP method has a particular ability to compare each criteria and indicators (thematic layers) based on their relative importance in group decision making for the identification of potential ecotourism sites (Saaty & Vargas, 2012; Mobaraki et al., 2014). This study used two primary criteria consisting of four indicators (sub-criteria), namely, landscape/naturalness (visibility and land-cover/vegetation-cover) and topography (elevation and slope) to indicate more potential ecotourism priority sites (Table 1). These criteria and indicators were determined based on the characteristics of the landscape, literature survey, expert knowledge, and information from various sources. Visibility (scenic attractiveness), slope, and elevation factors were generated from a digital elevation model (DEM) having 30 m spatial resolution. Percentage rise for slope was applied to generate slope layer, which was further reclassified into four suitability classes such as very high, high, moderate, and low (see also Sahani, 2019). Based on the characteristics of the study landscape, the elevation and slope classes were evaluated from topographic attractiveness for ecotourism significant feature, where extremely higher and lower slope and elevation were ranked as less/not suitable and higher and moderate slope and elevation ranked as more suitable. Visibility factor (scenic attractiveness) was integrated with the potential of location for naturalness to allow visitors to view the surrounding landscapes on the bases of visible and not visible. Vegetation-cover characteristics were generated from the Landsat satellite image of 2020 having 30 m spatial resolution, which was classified into four classes (Table 1). Investigated indexes in evaluating ecotourism potentials of different destinations and regions have indicated the existence of various ways of giving weights to criteria and/or indicators. In this research, each criteria and indicator received a weight and a score which represented its relative importance in the suitability evaluation. The weight of each indicator (thematic layer) was assigned to each factor (0 to 4 rating) on the basis of the determination of ecotourism potential sites where rating “0” represents least importance and rating “4” indicates most important for ecotourism potential (Table 1).

Table 1
Criteria and indicators in site suitability analysis for CBET planning at the LWW

SN	Criteria	Indicators	Category	Suitability	Score	Weight (%)
1	**Landscape/ naturalness**	Visibility	Good visibility	Highly suitable	4	30
			Poor visibility	Not suitable	0	
		Vegetation cover	Dense cover	Highly suitable	4	35
			Moderate cover	Moderately suitable	3	
			Low cover	Marginally suitable	2	
			No cover	Not suitable	0	
2	**Topography**	Slope (%)	Low (0–15)	Less suitable	1	20
			Moderate (15–40)	Moderately suitable	3	
			High (40–60)	Highly suitable	4	
			Very high (> 60)	Marginally suitable	2	
		Elevation	> 3260 m	Not suitable	0	15
			3150–3260 m	Highly suitable	4	
			3020–3150 m	Moderately suitable	3	
			2910–3020 m	Marginally suitable	2	
			2800–2910	Less suitable	1	

Furthermore, unique places for eco-lodges and eco-camps were also collected to identify potential ecotourism attractions using GPS in the form of point feature data by focusing more on those areas which were not yet included under WETA's jurisdictions (Table 2). Finally, discussion was made with WETA experts and knowledgeable local stakeholders to make a final decision on the selection of suitable sites for eco-lodges and eco-camp operations.

As part of the process of LUP for CBET potentials, integrated management zone approach is important to identify the types of activities that are permitted in specifically defined zone, as well as delimiting those activities that are not permitted for that specific zone. The approach aims at classifying land development uses within management zones according to the levels of sensitivity and suitability of each zone. The land-use management zone planning at the LWW and its adjacent landscapes is basically the

continuation of potential site suitability identification for CBET planning. Data for integrated management zone planning was collected using, GIS and remote sensing, extensive literature survey, KIIs, field observations, and expert knowledge. To identify the possible land management options, the study area was stratified into five basic land management zones based on the bio-physical characteristics, visual interpretations of the field conditions, field verification (ground–trothing), the high resolution Google Earth image, literature survey, and the background knowledge of the study area.

Table 2
Suitable places for eco-lodges and eco-camps in the LWW collected using GPS

Place name	Altitude	latitude	Longitude	Suitability
Kella	3108	376510	971707	Eco-lodge
Kibi Goro	3273	379411	974079	Eco-lodge
Geba Robi	3202	379821	974042	Eco-lodge
Hontu	2926	378541	970965	Eco-lodge
Mount Chulta	3315	384188	970791	Eco-camp
TulluDhera	3262	381071	970272	Eco-camp
Zaafi Abba-gurracha	3194	380164	969696	Eco-camp
Guba Inrensa	3152	379231	969272	Eco-camp
Shero	3068	378659	969165	Eco-camp
Lega Tebela	2810	378321	970309	Eco-camp
Merfo	3105	377010	969048	Eco-camp
Mount Gule	3058	379464	971349	Eco-camp
Unnamed	2964	379086	971804	Eco-camp
Lakeshore (as required)				Eco-camp

Then, the researcher, natural resource experts and individuals who are well known about the social-ecological conditions of the study area were assigned to evaluate and decide the final land-use management zones according to the potential of the site, the degree of sensitivity and severity to the local context, which was actually guided by the principles and concepts of sustainable ecotourism development. Finally, the information obtained through site suitability analysis and other relevant considerations were synthesized to produce the integrated management zone map of the study area.

2.2.3 Data Analysis

ArcGIS 10.3 was employed for site suitability analysis to identify potential CBET sites in the LWW and its adjacent landscapes. Visibility (scenic attractiveness) was analyzed using view-shed analysis tool in

ArcGIS environment on the basis of visible or not visible (lines of sight). Image analysis for vegetation classification was performed using supervised classification. To reduce impurities further analysis was done using the ‘reclassify’ function that resulted with the final 4 reclassified map classes. Topographic features (slope and elevation) were analyzed and mapped using ArcGIS. Based on, the given criterion and factors, the spatial data of the four indicators as a set of GIS thematic layers were overlaid to produce a composite map. Then, classifying the composite map into different potential ecotourism suitability sites based on their relative importance was done through weight overlay of the factor maps. After the overlay, analysis of the given factors the point feature data was added to generate suitable CBET potential site map of the LWW and its adjacent landscape. GIS was also applied to produce management zone planning site maps. The qualitative data captured through KIIs, field observation and document analysis were analyzed mainly using context analysis and qualitative descriptions.

3. Results

3.1 Identification of potential ecotourism sites

For the identification of potential CBET sites areas were divided into visible and not visible, where visible areas are highly suitable and less visible/not visible areas are less suitable for ecotourism attractions (Fig. 2a). Similarly, the distribution of vegetation cover was divided into four classes as dense vegetation-cover, medium/moderate vegetation-cover, low vegetation-cover and no vegetation-cover; where dense vegetation-cover indicates higher suitability and areas with no/less vegetation-cover indicate lower suitability for ecotourism attractions (Fig. 2b). Elevation and slope classes were evaluated from topographic attractiveness for ecotourism significant feature, and classified into four classes as high, moderate, marginal and low. Even though, adventure tourists basically prefer to visit extreme elevation regions in the mountain, extremely cold and snow-covered climate (very high elevations) sharply reduces the possibility of human settlement and/or activities and is not suitable for ecotourism site development. Whereas, moderate to high elevation and slope are more favorable for larger number of eco-tourists, and, are more preferred for ecotourism site suitability developments (Fig. 2c & d).

The results from landscape/naturalness (visibility and vegetation-cover), and topography (elevation and slope), and point feature data were combined to produce site suitability map for the LWW and its adjacent landscapes (Fig. 3). This site suitability map resulted with four suitability classes, including less suitable, marginally suitable, moderately suitable and highly suitable. The less suitable class encompasses larger proportions of the study area, such as lower slope areas, low or no vegetation covers (including the lake surface), settlement areas (including Hero Wanchi town), and wetlands. The less suitability result of the water surface (including Lake Wanchi) is mainly attributed to the lack of vegetation cover where it was considered as no vegetation cover (i.e., not suitable). Marginally suitable class covers those areas mostly occupied by agricultural lands, settlements and some agroforestry trees. Moderately suitable areas are those areas mostly covered by shrub vegetation and, situated at the middle to high altitude/slope having relatively less settlement and agricultural activities. Highly suitable class are those areas with relatively better vegetation cover including Kibate and Tilika forests, riverine vegetation,

mount Gule, and those areas having scattered dense vegetation located at the middle to higher elevations. Generally, those areas classified as moderately and highly suitable should be considered for the different CBET experiences. Within these identified potentially suitable sites (moderately and highly suitable areas) more suitable sites for eco-lodges and eco-camps were specifically located (Fig. 3).

3.2 Integrated management zone planning

Zoning is a management tool that helps to utilize and maximize the potentials of ecotourism destinations. Integrated management zone helps to define the purposes for which each part of a given area can be utilized to its maximum potentials, while allowing greater flexibility in dealing with different human activities and needs. The management zonation in the LWW and its adjacent landscapes was based on the outcomes of the site suitability analysis described above, which considered all the parameters (criteria and indicators) for ecotourism development including bio-physical and socio-economic characteristics, and related ecotourism attractions/opportunities. Accordingly, five key management zones were identified for the LWW and its adjacent landscapes, namely, protected zone, which covers 11.5% (411 ha), multiple use zones 33% (1177 ha), sustainable use zone 13% (464 ha), specific use zone 35.75% (1273 ha), and rehabilitation zone 6.7% (411 ha) (Fig. 4).

4. Discussions

The LUP steps for CBET may not always be forward, linear and regular due to obstacles in the environment and challenges related to stakeholders. Each CBET case may be unique in terms of its destination characteristics and phase of development (Tasci et al., 2013). There is no one-fits-all framework or blueprint applicable to all destinations. Nonetheless, it should be known that the LUP processes for CBET must be participatory, flexible, adaptive and responsive to the potential obstacles. The LUP at the LWW and its adjacent landscapes demonstrated the potential of using CBET planning as a powerful tool to guide a more locally-appropriate ecotourism development that fits with other community needs, initiatives, and opportunities. These and other LUP processes for CBET potentials and their implications for sustainable landscape management, biodiversity conservation, local livelihood improvements and the satisfaction of eco-tourists were discussed in relation to available relevant literatures.

4.1 Identification of potential ecotourism sites

Landscape/naturalness and topography are usually considered when identifying potential sites for ecotourism development planning. Areas that are best suited to different types of eco-tourists and ecotourism experiences were selected based on their landscape naturalness (visibility and vegetation-cover), and topographic (elevation and slope) characteristics in the LWW and its adjacent landscapes. Similarly, studies elsewhere indicated that visibility and vegetation/land-cover, and elevation and slope are the most important dimensions of attractiveness in landscape, scenic beauty or the topographic attractiveness for ecotourism (Bunruamkaew and Murayama, 2011; Šiljeg et al., 2019). There exists a

positive relationship between landscape/naturalness and ecotourism attractions, i.e., an area's degree of landscape naturalness for ecotourism attraction is mainly expressed in terms of visibility (scenic attractiveness) and vegetation-cover. Topography in the form of elevation and slope are also frequently used to identify potential ecotourism sites. For instance, considering slope as the determinants of the level of land, low lying areas are prone to flooding (Pareta, 2013), whereas, from ecotourism point of view higher slopes are favored for some ecotourism adventures, like mountain trekking (Bunruamkaew & Murayama, 2012).

As indicated in Fig. 3 above, the study classified the LWW and its adjacent landscapes into four suitability classes, of which the moderately and highly suitable sites are identified as the most ideal places for the different CBET experiences. In addition, within the identified suitable sites the study specifically suggested four potential places for eco-lodges and nine for eco-camps (see Table 2) excluding the usually used lakeshore lodges and campsites without the environmental impact considerations. The selection of these eco-lodges and eco-camps was based on the principles of ecotourism planning; for instance, eco-lodges and eco-camps should be some distances away from community villages, while greater attention was also given to the elements of the natural environments, with particular emphases to the lake and its adjacent landscapes. Indeed, the planed CBET should be managed in such a way as to have minimal environmental and social impacts; non-consumptive; capable of providing desired economic benefits to local communities; compatible with other resource uses in the locality; and appropriate in scale for conditions and local natural and cultural resources. In other words, the selection of these eco-lodges and eco-camps was based on the principles of sustainable ecotourism development that makes the planned CBET to be environmentally friendly, economically feasible, socially responsible and culturally acceptable (WWF, 2001).

The presence of ecologically sound eco-lodges and eco-camps also creates additional job opportunity for guiders, cookers, horse-renters, luggage transporters, room cleaners and keepers. For instance, one organized service groups of horse-renters or luggage transporters may take the eco-tourists from the newly proposed Kella eco-lodge to Kibi Goro eco-lodge, after which another group may take from Kibi Goro to Geba Robi eco-lodge and another third group to the next eco-lodge or eco-camps and so on (see Fig. 3). This allows the visitor to spend every night at different eco-lodge or eco-camp. Currently, ecotourism services such as the integration of the natural life into CBET activities occurs in the form of mountain tours, hiking, boat trips across lakes, wildlife/bird-watching, and tour-guides are rendered by WETA. Equally important are the elements of intangible culture that belongs to the community, such as horse riding, local arts and crafts, cultural dances, and coffee ceremony are actively utilized as a CBET attractions. Similarly, research on CBET lodges in Costa Rica revealed many different types of services provided by community groups including agricultural and food products, local services (e.g., laundering), boat trips, food stalls, horse rides, medicinal plant gardens and orchards (Trejos and Chiang, 2009). However, to be effective and competent in business making, more can be learned from the successful experiences of the model CBET in Ethiopia, the Integrated Forest Management project Adabba-Dodola. The Adabba-Dodola CBET have five traditionally styled forest camps in the Arsi-Bale mountains massifs

for visitors, where organized community service provider groups such as camp keepers, guides, horse providers or assistants get their service revenue directly from the visitors (Kunert, 2000).

In principle, ecotourism destinations should have strategies to generate enough revenue to cover its operating expenses and an extra amount to invest in conservation and community development priorities. One of such revenue generation techniques from eco-tourists is lengthening the eco-tourists overnight stay in the destinations. The more the eco-tourists stay in the destinations the more they expend money for their daily needs. However, the absence of ecotourism facilities, specifically accommodations, eco-lodges, and eco-camps makes WETA the loser of this opportunity. This was explained well during the key informant's interview where one key informant describes the situation as: s*ince eco-tourists have no means of opportunity to pass overnight at Wanchi ecotourism destination, they took the money back with them and may be spend it somewhere else with much less enjoyable activities, and this gives WETA the nick-name "the loser of Dollar".* This type of leakages or earnings spent outside of the local economy can significantly devalue the economic linkages to support local residents and ecotourism development activities (Tasci *et al*., 2013). Though, achieving these strategies will depend upon a site's significance as an ecotourism destination and the management and marketing capabilities of the ecotourism managers, and technical staffs, there are issues to be considered for WETA. Of the many issues to be considered devising the mechanism of lengthening the eco-tourists (over-night) stay in the destination is the most important.

Nevertheless, locals may not have financial ability in actualizing infrastructure improvements and enterprise development, even at small and medium levels. However, the government can assist in developing the necessary infrastructure (roads, electricity, and telecommunication) to form attractive ecotourism products. Currently, some activities are under way to alleviate some of the above mentioned problems, for instance, the Lake Wanchi-Dendi nationally owned ecotourism project under "Gebeta Lehager" by the government of Ethiopia has already started some infrastructural developments mainly of road network construction works that connects particularly the four proposed eco-lodge sites. The construction of road that connects, Kella to Hontu, Kella to Kibi Goro, and Kibi Goro to Gaba Robi, is currently under way (see Fig. 3). With regard to the problem of accommodations, particularly of the eco-lodges and eco-camps, an ecotourism company named as "Burka Wanchi Share Company", which was established recently by the commitments of some locally borne individuals residing abroad and at Addis Ababa, including the local communities as shareholders has already started the construction of eco-lodges at some of those sites selected and recommended by this study, mainly at Kella site. Alongside solving the accommodation problem, as per one of its objective, *natural resource conservation, environmental protection and ecosystem restoration*, the company is effectively and closely working with WETA, and the Lake Wanchi-Dendi ecotourism project in the rehabilitation and sustainable development of the LWW and its adjacent landscapes.

4.2 Integrated management zone planning

A carefully planned management zoning system for ecotourism destination is a powerful tool in ensuring visitation occurs in places and in ways that are within the capacity of an area's management that

maximizes benefits and limits negative impacts. Management zones are to a large extent aligned with the zoning requirements in terms of activity types (Šiljeg et al., 2019). This study suggested five management zones based on environmental sensitivity and ecological importance that are characterized as protected zone, multiple use zone, sustainable use zone, specific use zone, and restoration zone (see also Calanog et al., 2012; Ohadi *et al.*, 2013). Each zone is clearly defined in order to promote the integrity of the ecosystem and natural resource base. It is envisaged that specific land-use and/or ecotourism activities were assigned to each zone, based on the sensitivity, suitability and ecological role of the local conditions and current use of the management zone type.

4.2.1 Protected zone

This zone mainly includes most of the shrub lands (dominated by *Erica* species), which is critically important for the existence of the watershed including the lake. It was identified that shrub land-cover greatly contributes for the natural ecological processes and functions of the LWW and its adjacent landscapes (Angessa et al., 2020). It also covers zones of valuable natural vegetation and environmentally sensitive areas such as small streams (contributing water for the lake), and hillsides, areas with greater than 25% percent slope raise, which should be protected and conserved, while not being suitable for intensive development activities (see also LVPC, 2008; Šiljeg et al., 2019). Accesses to this zone are limited and only research activities, medicinal plants collections, beehives, and environmental monitoring should be allowed by responsible authorities (see also Bunruamkaew & Murayama, 2012; Ohadi et al., 2013). They are largely self-sustaining through natural regeneration processes (which is the characteristics of *Erica* species), but rehabilitation works may be allowed based on valid recommendations (e.g., reintroduction of indigenous wildlife species may be undertaken).

Any human land and land-resources use, such as clearing, farming, settlement, commercial utilization, fuel-wood collection or other activities harmful to biodiversity conservation must be excluded (Calanog et al., 2012). Agricultural activities and the introduction of non-native species such as *Eucalyptus* should be abandoned from this zone. Accommodations and lodges for eco-tourists should be also excluded and visitor use should be managed and must be under strict permissions, so as to not cause any significant biological or ecological degradation to the natural resources of the area (Drumm e*t al.*, 2004; Ohadi et al., 2013). The important reasons for the protection of these areas are to minimize disturbance by careful planning and execution of research and other approved activities, and to safeguard structural landscape features mainly from soil erosion perspective in the ecologically highly fragile and easily degradable sloppy lands (see also Drumm *et al.*, 2004; Šiljeg et al., 2019). In addition, it could be taken as an opportunity in providing an area where biodiversity and ecological studies can be demonstrated in as pristine an environment as possible, that is, it may serve as a reference points to measure the impact of human-induced change that is not confined to particular areas. Management efforts should, therefore, be focused on conservation and/or regeneration of natural vegetation cover, due to its role in biodiversity conservation, ecosystem services provision, wildlife support, water regime regulation, soil improvements and recreational opportunities.

4.2.2 Multiple use zones

This zone includes vast areas of the south and southwestern of the Lake Wanchi that can have varying degrees of human activities such as human settlement, traditional and sustainable land-use, subsistence agriculture, agroforestry, apiculture, extraction activities, and other income generating or livelihood activities (see also Ohadi et al., 2013). But, there are also some areas in the northern and eastern part of the lake that should serve as buffers to the protected zones and the multiple use functions. Visitors can have activities such as sightseeing, eco-lodging, eco-camping, walking, hiking, horse riding. The best known of such areas are, Hero Wanchi Town, Hero Michael, Lime, Kella, Mt. Chulta, Mt. Dhera, Geba Robi, and Shero. The main purpose is to maintain the harmonious interaction of nature and people, i.e., to support lifestyles and economic activities which are in harmony with nature and the preservation of the social and cultural fabric of the local communities. For instance, some agroforestry practices including enset cultivation that has evolved in association with cultural management systems can only survive if those management systems are maintained (see also Dudley & Stolton, 2008). It is also to encourage scientific and educational activities which will contribute to the long term well-being of resident populations and to the development of public support for the environmental protection of such areas.

4.2.3 Sustainable use zone

The aim of this zone is to contribute to the welfare of the local community though the provision of limited development and ecotourism activities. Non-extractive and non-consumptive uses such as agroforestry activities (enset cultivation, horticultural and fruit tree plantations), and apiculture are the most feasible economic activities in this zone. Specific to the current study area, enset that serves as food, feed and cash crop (see Angessa et al., 2021) is largely maintained in this land-use management zones. Residents are allowed to collect and utilize natural resources using traditional and sustainable practices that enhance biodiversity conservation. This type of zone is also suitable for soft-ecotourism activities such as home-stay and for those eco-tourists which are not interested in adventure and hard activities. All permanent settlements or villages surrounding the lake located at gentle slopes, including the large peninsular village, have suitable conditions for such activities, and are proposed as the heart of this zone. It is simply to provide a foundation and to allow low-impact recreational, spiritual, and socio-economic, and visitor opportunities, all of which must be environmentally, socially and culturally compatible (see also Calanog et al., 2012; Ohadi et al., 2013). This zone also acts as a buffering against the protected zone.

4.2.4 Specific use zone

This zone is designated as special use zone which is defined as a zone with vast and adverse environmental impacts. It is to protect natural and scenic areas of national and international significance that are ecologically sensitive and are not being suitable for intensive development. Visitor use should be for inspirational, spiritual, cultural, and recreational purposes at a level which will maintain the area in a natural or near natural state. Clearing, farming, settlement, commercial utilization, or other activities harmful to biodiversity conservation are not allowed. It includes mainly environmentally sensitive areas

such as the lake, lakeshore wetlands and vegetation (up to 30 m serving as Lake Buffer), riverine areas including “Laga Gulee”, “Horaa Loonii”, “Laga Xabalaa”, “Dawwalaa”, and “Hora Harree”, upper plain wetlands (hurufa Haroo), Kibate and Tilika forest areas. The zone is suitable only for short term stay and non-motorized boats are allowed on the lake surface. This zone specifically the forest areas are serving as a linking habitat (corridors) connecting the different management zones.

4.2.5 Restoration zone

These are environmentally degraded areas mainly due to agricultural activities that need to revive its natural habitat and biodiversity. These are most of the areas to the eastern part of the lake, particularly of the shrub vegetation affected by subsistence crop cultivations (non-WETA managed lands). Natural regeneration is done through natural processes as a result of protection or elimination of human actions, for instance, abandoning of agricultural activities and the introduction of non-native species such as *Eucalyptus* from sloppy lands. Time-limited human assisted restorations through reintroduction of extirpated indigenous species (both plants and animals) may be allowed to restore seriously damaged areas, nevertheless, exotic species are not allowed in the restoration process. Existing houses and agricultural developments are eventually phased-out in a timely manner (see also Calanog *et al.*, 2012).

4. Conclusion

The LUP processes, strategies, and activities for ecotourism potentials requires a deep understanding of the social and economic drivers at work in land-use pattern, and necessitates agreement among the local community and policy-makers regarding the use of natural resources. To be optimal, environmental sustainability, economic viability, social justice and cultural integrity should characterize the LUP processes, while its implementation should be legally possible under the prevailing legislation. The major factors considered in data collection for LUP for CBET potentials at LWW and its adjacent landscapes were site suitability analysis through GIS and remote sensing application to identify the potential CBET sites and integrated management zone planning for effective application and implementation of the CBET planning process. It also incorporated the social-ecological systems such as biodiversity conservation, sustainable land management, landscape and ecological restorations, and local livelihood systems. The fundamental objective was to financially motivate local communities to conserve the natural and cultural resources through the revenues generated from the ecotourism activities, while also fulfilling the satisfaction of the visitors.

The areas that are best suited to different types of eco-tourists and ecotourism experiences were selected mainly based on the landscape/naturalness and topographic characteristics of the study watershed. The site suitability selection resulted with four suitability classes, including less suitable, marginally suitable, moderately suitable and highly suitable areas, where the moderately and highly suitable areas were recommended for the different CBET experiences. Besides, within these selected suitable areas four unique places for eco-lodges and nine for eco-camps were identified, and integrated with the site suitability analysis to produce site suitability map for the LWW and its adjacent landscapes. Furthermore, five key management zones, namely, protected zone, multiple use zones, sustainable use zone, specific

use zone, and rehabilitation zone were identified for the successful implementation of the CBET in LWW and its adjacent landscapes.

Generally, the LUP at the LWW and its adjacent landscapes demonstrated the potential of using CBET planning as a powerful tool to guide a more sustainable ecotourism development that fits with other community needs, initiatives, and opportunities. Therefore, this CBET planning based on the potential of the site can provide direct benefits that can offset pressure from other less sustainable activities that make use of natural and cultural resources and reduces the undergoing environmental degradations and socio-cultural deteriorations. Finally, an important lesson to be learned from the LWW and its adjacent landscape ecotourism situation is that to take the full advantage of the benefits of ecotourism development for rural communities, there must be established systems to increase the utilization of local linkages especially those that have a higher impact on the local economy such as accommodations and related facilities.

Declarations

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Conflict of Interest: The author declares that he has no conflict of interest.

Data availability statement: The data that support the findings of this study are available upon reasonable request.

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Figures

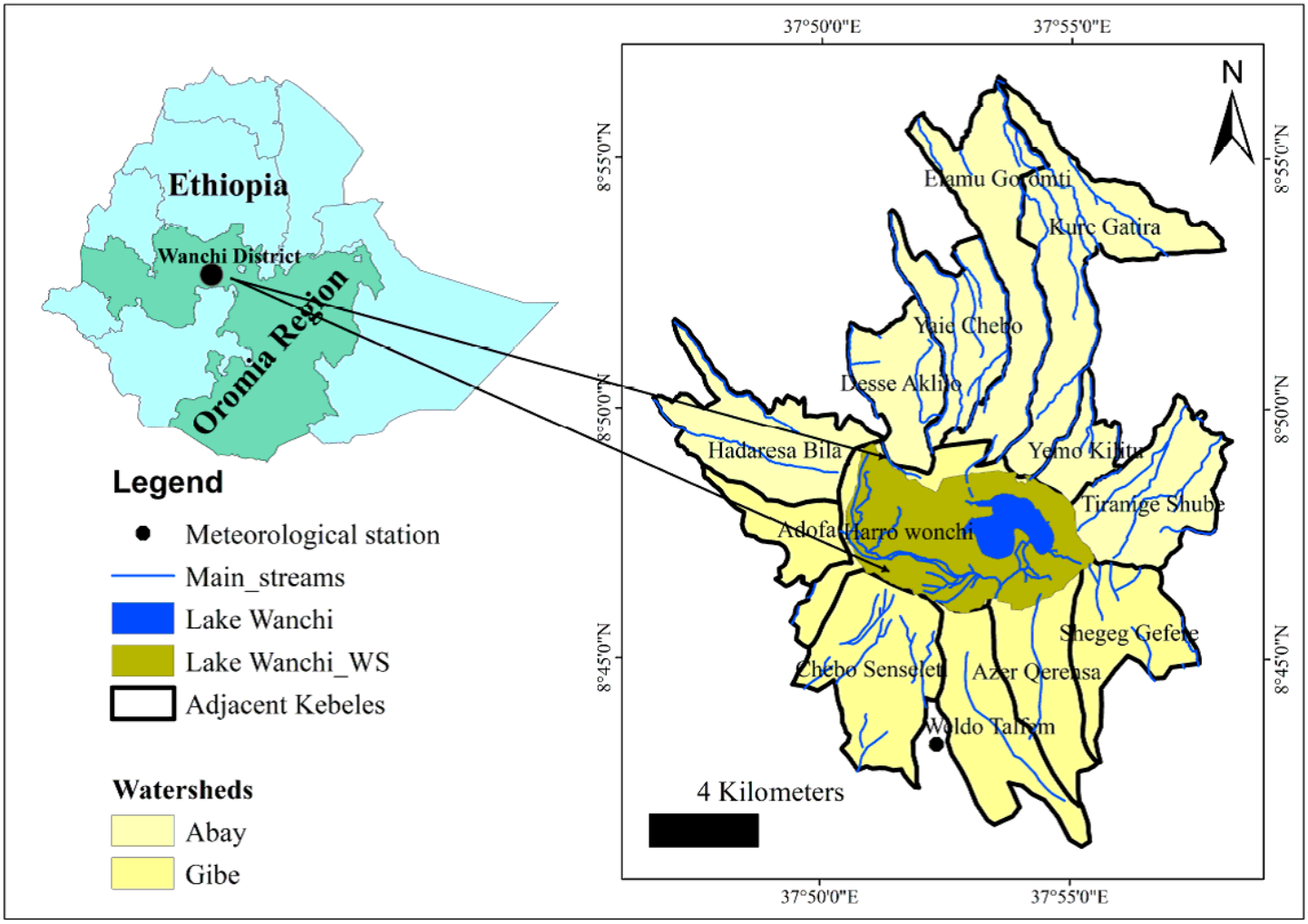

Figure 1

Map of the study area

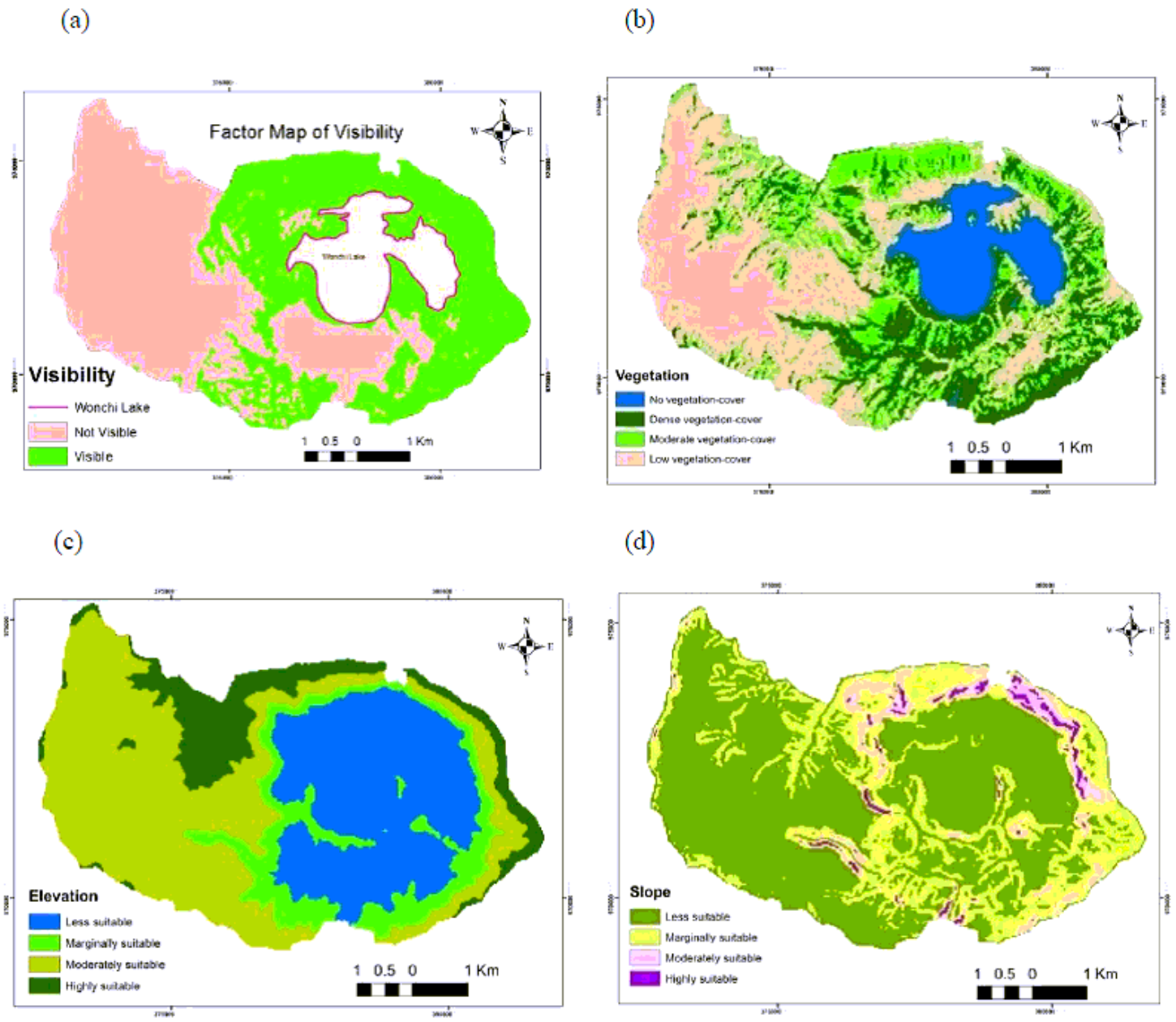

Figure 2

Factor maps for site suitability selection for CBET potentials in LWW and its adjacent landscapes, (a) visibility, (b) Vegetation cover, (c) Elevation and (d) Slope

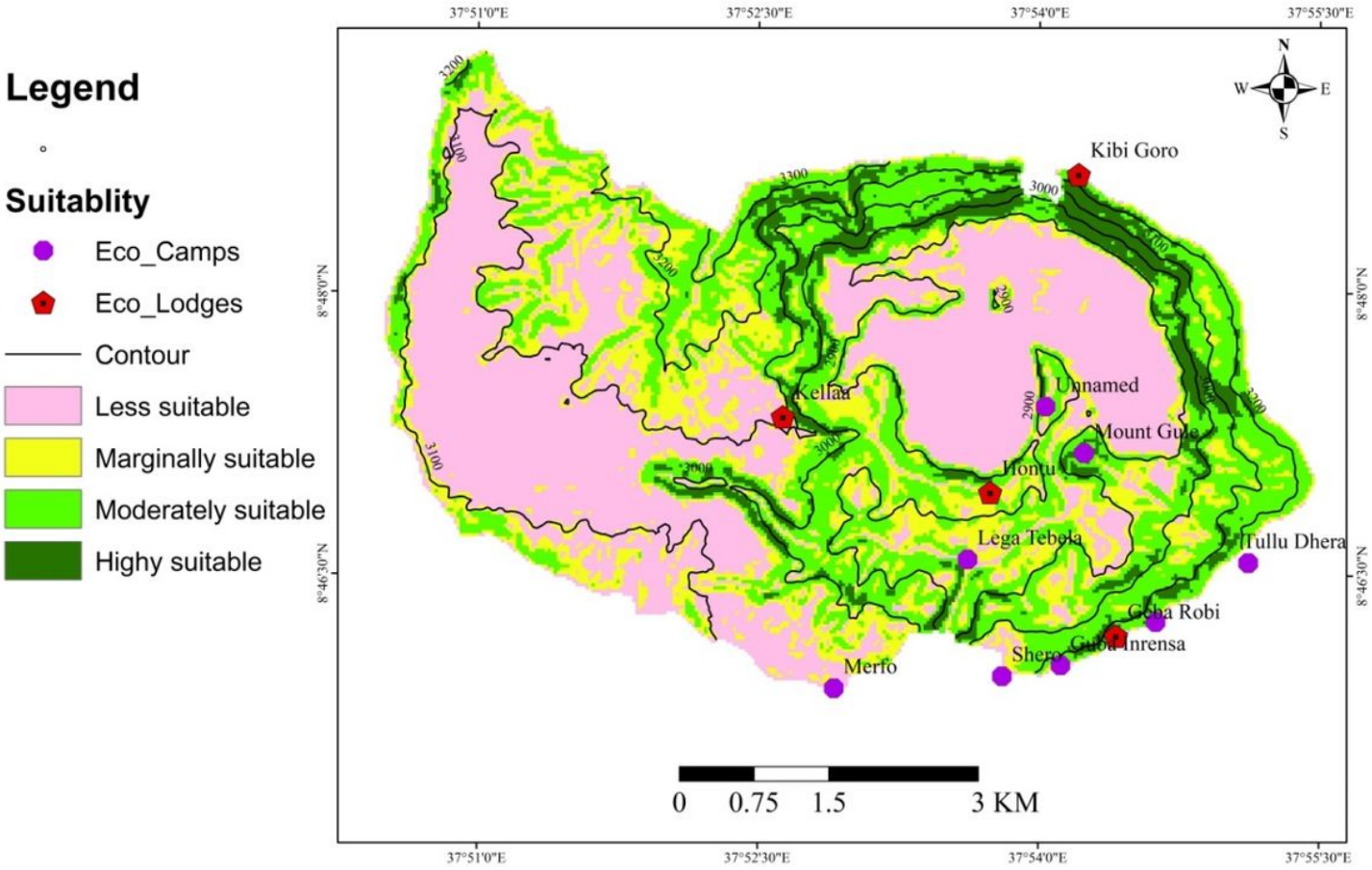

Figure 3

Site suitability map in the LWW and adjacent landscapes including potentials sites for eco-lodges and eco-camps

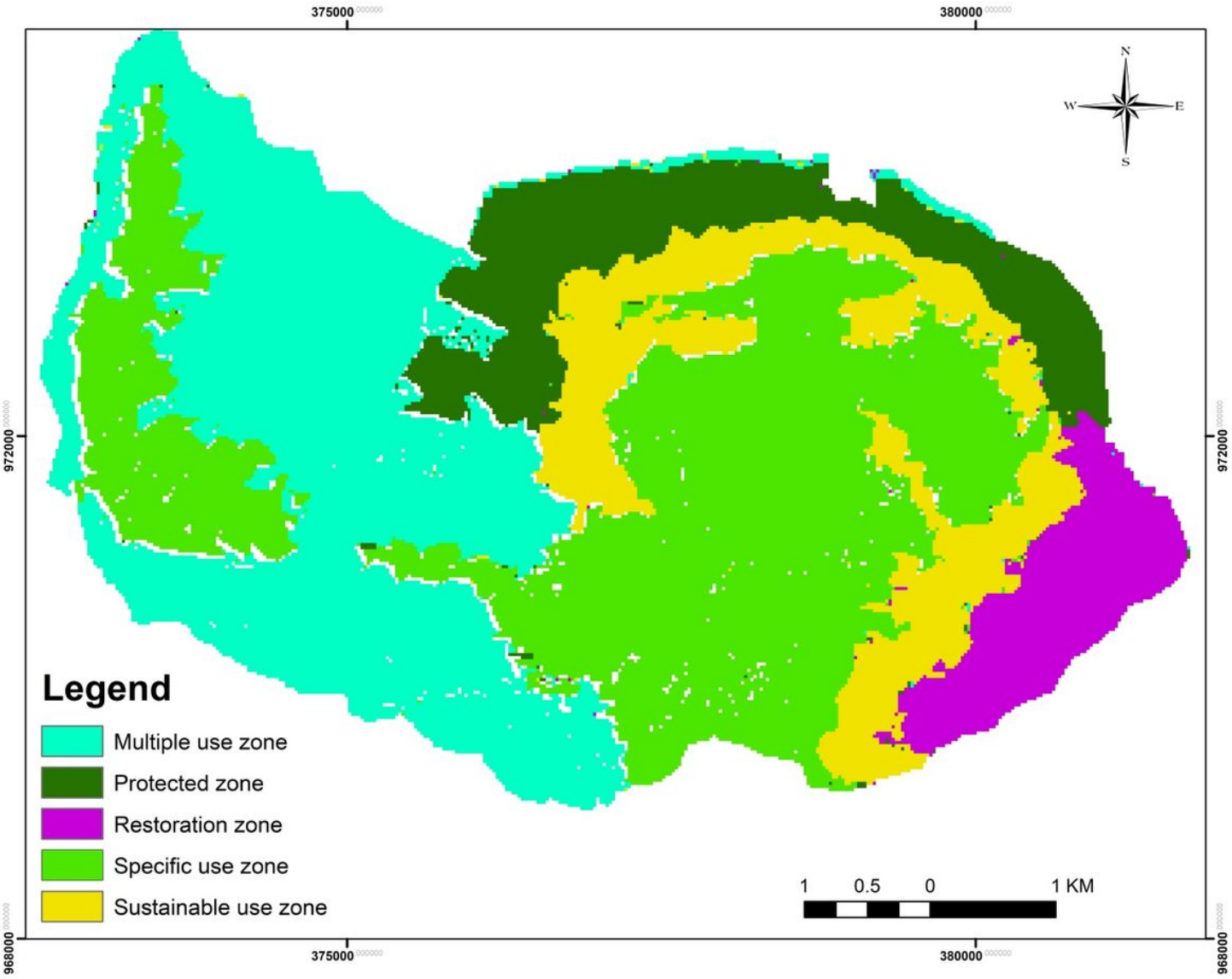

Figure 4

Map of suggested integrated management zones planning for LWW and its adjacent landscapes